# The Politics of Growth:
# Can Lobbying Raise Growth and Welfare?*

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This draft
July 03, 2009

**Abstract**

This paper aims at analyzing the effects of lobbying over economic growth and primarily welfare. We model explicitly the interaction between policy-makers and firms in a setup where the latter undertakes political contributions to the former in exchange for more restrictive market regulations which induce exit and enhance the profitability of the market. In a sectorial equilibrium, despite stimulating growth, lobbying restricts the market structure and reduces welfare when compared to the free-entry outcome. However, once general equilibrium considerations are taken into account, we find that lobbying may improve welfare over a welfare maximizing free-entry equilibrium, by means of an expansion in aggregate demand. This introduces a new paradigm in the literature about the effects of lobbying over economic performance.

JEL classification: D72, L13, O31.
Keywords: Lobbying, Market Structure, R&D Investment, Growth, Welfare.

*I am extremely grateful to José Tavares for precious comments and suggestions. I also express my gratitude to Maria Eugénia Mata, José Faias, José Costa and Stijn Goeminne, and to all participants in the IRW-FEUNL (Lisbon, November 2008), in the $16^{th}$ Symposium on Public Economics (Granada, February 2009) and in the $3^{rd}$ Meeting of the Portuguese Economic Journal (Funchal, June 2009). Financial support from Fundação para a Ciência e Tecnologia (BD/36542/2007) and from Fundação Amélia de Mello is acknowledged.

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# 1 Introduction

It is a well acknowledged fact in the literature that most rent-seeking activities have baneful implications, not only over economic growth, but also over welfare.[1] In the pursue of profits, most firms undertake a variety of actions, such as lobbying, tax evasion, litigation, corruption, or even theft, which are individually profitable, but completely wasteful from the society's perspective. Described by Boumol (1990) as "unproductive entrepreneurship," since they have the knack of reducing the set of resources applied on the real side of the economy, cutting down production and slowing down growth, these activities are usually brought into economic models through an exogenous technology which transforms real resources in profitable activities for firms while adding no productive return to the society.

However, we believe that such perspective may provide an inaccurate analysis of the rent-seeking phenomenon, specially because it often ignores agents' interplay in determining the aggregate behavior of the economy, taking the loss of real resources that could have been used in productive activities as given. Understanding the forces that drive economic decisions and the interaction between players, as well as the general equilibrium repercussions of such actions, which may be specific to the type of activity, is essential to depict the true effects of rent-seeking over economic growth, and primarily welfare.[2]

This paper seeks to bring these considerations into analysis, in one very specific form of rent-seeking: lobbying. More specifically, we are interested in answering questions like: what determines political contributions and how do policy-makers react to cash transfers from lobbyist firms, what are the consequences of lobbying over market concentration and overall profitability of firms and how do firms respond to these changing conditions, namely in which concerns R&D expenditures, what are the general equilibrium repercussions of lobbying and how do all these changes in the economic environment affect economic growth, and most importantly welfare. In this sense, although our main focus is positive, we are ultimately concerned with a normative analysis of lobbying, namely those activities which take the form of political contributions, either in cash or in kind.

### The relevance of lobbying

Lobbying has become a multi-billion dollar industry in the U.S.. Every year, special interest groups – corporations, industry groups, labor unions, and

[1] Classical works on the effects of rent-seeking on economic performance include Krueger (1974) and Bhagwati (1982).

[2] In fact, rent-seeking, can take many forms, and not all of them can accurately be connected to lower economic performances. For instance, Bardhan (1997) cites some historical examples where rent-seeking is thought to have promoted growth.

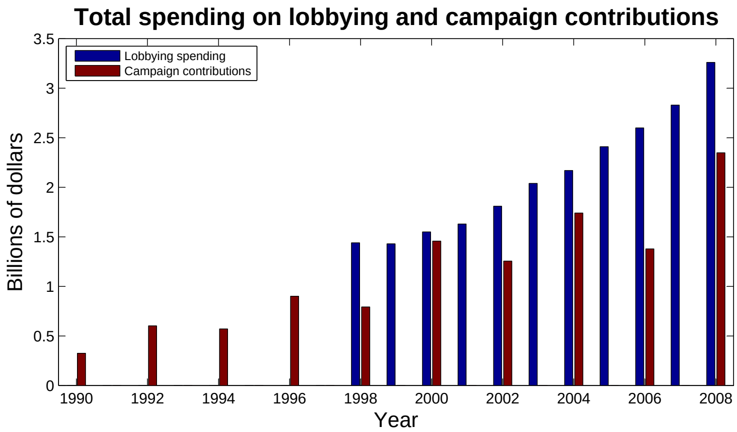


Figure 1: Total expenditures in lobbying and campaign contributions by special interests. Since federal campaigns are concentrated every two years, data on campaign contributions concern all expenditures undertaken from special interests on the two years prior to the elections. This data was collected from the Center for Responsive Politics.

single-issue organizations – spend billions of dollars to lobby the Congress and federal agencies, in an attempt induce policy-makers in power to pay attention to their issues and influence decision-making. Some of these special interests retain lobbying firms, others even have lobbyists working in-house. In addition, billions of dollars are also spend by these special interests in campaign contributions every two years, when federal campaigns are held and elections to the Congress take place. They do not do so lightheartedly, however – contributors expect that money transfers incurred during political campaigns are repaid back latter by the beneficiaries, in the form of favorable legislation, less stringent regulations, political appointments, government contracts or tax credits, just to name a few.[3] In fact, the costs incurred by special interest groups in lobbying and campaign contributions are a small drop in the ocean as compared to the benefits they can reap if their efforts are successful. Figure 1 reports the magnitudes implicated in lobbying since data was made available by the Center of Responsive Politics.[4] Although subject to a tighter regulation, lobbying in the E.U. has also become a reality, specially since late 1970's. Nowadays, there exist more than 15,000 lobbyist in Brussels, representing the most various interests, all of them seeking influence in the EU's legislative process.

It is precisely the policy actions resulting from successful lobbying that,

[3]American political campaigns are, nowadays, analyzed in a much wider context than simple cash transfer from special interest groups to political agents with the objective of affecting the perspective voters have about candidates. For example, in a recent paper, Grossmann (2009) observe the political campaigning in the U.S. as an industry itself, with potential repercussions over American political competition.

[4]This data, as well as a more exhaustive explanation of the lobbying framework in the U.S., is available in the following address: http://www.opensecrets.org.

we argue, the literature has taken lightly, by ignoring the individual reactions of economic agents to such change in the course of action – a black-box perspective. Decision-makers, by changing policy and the economic environment faced by special interest groups, can motivate changes in individual behavior, which, in turn, may be endowed with extra repercussions at the macroeconomic level. It is our objective in this paper to dig in the source of special interest politics, which will hopefully shed some light over the specifics of political interaction, through a build in understanding of both partial and general equilibrium relationships and consequent repercussions on market structure, growth and welfare, as a result of lobbying. In particular, we observe that lobbying, by determining the market structure and the profitability of firms, has critical implications not only over households income, but also over productive decisions undertaken by firms, inclusively expanding aggregate demand in the general equilibrium. The resulting interaction between market structure, growth and welfare is complex, and the final outcome depends on several economic effects that may predominate in equilibrium. Ultimately, lobbying activities might even improve welfare over a welfare maximizing free-entry equilibrium.

### The model: an overview

In order to focus on our objective, we borrow the general equilibrium framework from Peretto (1996, 1998), and consider an oligopolistic market with an endogenous number of firms, each of whom producing a differentiated good and undertaking in house R&D that generates higher quality products.[5] In the economic market, these firms compete among themselves for market share, using prices and quality improvements to try to overcome their rivals in the quest of larger profits. However, these firms also participate in other more obscure market – the political market. In order to accurately capture the mechanics behind political decision-making, we follow the classical contributions on electoral competition and special interest politics by Grossman and Helpman (1996); Baron (1994) and Austen-Smith (1987), and consider an office motivated policy-maker, who realizes that, in order to win elections, both votes and money are needed. Therefore, we assume that he maximizes

[5] As acknowledged by Brou and Ruta (2007), whose paper is in the same spirit as ours, the number of active firms plays an extremely important role in determining the rate of innovation, suggesting that any theory which relates rent-seeking to growth is not complete without taking into account the interactions between market structure and R&D.
To our knowledge, the link between market structure and R&D dates back to Schumpeter (1942). Applications to economic growth, however, are more recent. Peretto (1996) is the first to explore the linkage between market structure and innovation in the growth context.
Aghion et al. (2005) provide an alternative model which also explores the inverted-U relationship between competition and innovation; however, their model lacks some relevant features to our analysis.

a weighted sum of welfare and political contributions, selecting the active number of firms in the market which best serves his interests.

We motivate this approach in two ways. In the first, the legislator or policy-maker affects directly the level of competition, by imposing an upward limit on the number of licenses granted.[6] Hence, any given firm who seeks in R&D a way to overcome its rivals is compelled to make cash transfers to the decision-maker; otherwise it faces the risk of being left behind its competitors who have decided to present the bureaucrat with a share of their profits. By shaping regulations, policy-makers are able to determine the total profitability of the market, influencing the total amount of contributions they receive. Obviously, we can re-interpret this scenario in a more drastic way, raising the discussion to the corruption field, where the government grants R&D licences in exchange for bribes. This last argument follows Shleifer and Vishny (1993), who suggest that government officials are monopolists over a type of good, in our case R&D licences, without which the private sector cannot pursue their own economic activity, and exert their monopoly power by demanding bribes from private agents in exchange for those licences.[7] A direct application of these arguments to economic growth can be found in Blackburn and Forgues-Puccio (2007), who consider that firms must acquire permits from corrupt public officials in order to pursue their private, growth enhancing, activities.

In the second interpretation, firms compete freely in the economic market, but decide to overcome their rivalry and form a lobby who represents their interests in the political market, in order to gain the necessary political influence that allows them to shape public policy in their favor. This perspective is advocated by some studies (e.g. Barnett, 2006; Mizruchi, 1989; Schuler et al., 2002), which point out that firms may benefit from collective action by presenting a unified voice, and strengthened by the results in Ozer and Lee (2009), who found no support for preference for individual action to collective action from firms with higher R&D intensities. The main objective of this organization is to use the political market to attain what cannot be attained in the economic market, due to anti-trust regulations - the maximization of the joint profit of its members. According to this perspective, politics is simply a more obscure, yet legal, way to obtain

[6]This policy does not need to be seen as a direct action undertaken by the policy-maker. There are many variables the government can influence, and most of them are not directly perceived as a consequence of lobbying or political contributions. For instance, the government can influence patent length, width, or even punishments when a patent is violated. All these regulations influence market profitability, and consequently interact with future contributions by the incumbent firms in the market.

[7]There is also a vast literature (see, for instance, Ades and Tella, 1999) emphasizing the relationship between market structure and corruption; and in particular, Bliss and Tella (1997) observe that bureaucrats can directly limit the level of competition within the market in order to extract large levels of surplus, by creating regulations that limit the entry of new firms.

some type of collusive outcome, which appeals to the thirst of candidates for political contributions. Policy-makers restrict the number of R&D licences available to firms, in order to create profitability conditions that can be partially appropriated in equilibrium.[8] For the sake of objectiveness, we adopt the second of these interpretations and consider that the policy-maker and the lobby bargain over the number of R&D licences (or the number of active firms), making a case of "licences for sale."[9]

### Our results: an overview

In the partial, or industry, equilibrium, we find that, if policy-makers regard contributions as "sufficiently important," lobbying induces a decrease in the number of active firms in the market as compared to the *laissez-faire*, or free-entry, equilibrium. Despite this policy being growth enhancing, since the larger amount of profits to be disputed among firms makes R&D activities globally more attractive, the impact over welfare is negative, since this growth effect is dominated by the increase in the markup and the reduction in the number of varieties. However, lobbying has also repercussions in the general equilibrium. As firms adapt their decisions in response to a more concentrated market, a disequilibrium in the labor market, characterized by an excess labor supply, arises, requiring a downward adjustment in the wage rate as compared to the size of aggregate demand. To put differently, lobbying, by creating profitability conditions in the market that free-entry would have otherwise eliminated, has generated an extra source of income for households – dividends –, therefore increasing the size of aggregate demand in terms of the wage rate. This adjustment also reinforces the partial equilibrium effect – since gross-profits have increased, contributions have become more attractive to the policy-maker, and the expansion in aggregate demand refrains the welfare effects of a further increase in market concentration. Hence, when compared to the free-entry *status-quo*, the new steady-state with lobbying comprises a simultaneous adjustment of the active number of firms and aggregate demand, with opposing effects over aggregate welfare. While the increase in market concentration leads to higher prices and a reduction in the number of varieties, which overcome the increase in the growth rate, given aggregate demand, the expansion in aggregate demand does not only allow households to adquire a more valuable consumption basket, but also entails a further growth effect, leading firms to increase their R&D efforts in an attempt to steal more business, now

[8]In addition, several empirical studies have shown that firms presenting higher R&D intensities invest more in political action – see Hart (2003); Alt et al. (1999) and Taylor (1997).

[9]This last expression is inspired in Grossman and Helpman (1994), who have used the expression "protection for sale" to illustrate how politicians are willing to grant trade protection for domestic firms in exchange for campaign contributions.

more valuable, to their competitors. Based on these interactions, we conclude that, even if the free-entry equilibrium is welfare maximizing, given the general equilibrium conditions, lobbying can dictate an improvement in aggregate welfare, through repercussions in aggregate demand which are materialized in the general equilibrium and can offset the negative effects inherent to a fall in the number of firms.

We also show that our economy with lobbying may be endowed with some complex issues, not present when firms are allowed to freely enter and exit the market. In particular, an equilibrium with lobbying may not exist, specially if decision-makers are too eager for political contributions, situation in which labor market clearing may not be attained for any wage rate. If an equilibrium exists, it may also not be unique, since labor demand does not need to be strictly decreasing in the wage rate, nor even continuous. Finally, we note that the relationship between the preference factor for political contributions and equilibrium welfare may be non-linear, which raises the possibility that moderate levels of lobbying may have beneficial effects over aggregate welfare, but excess lobbying may become highly prejudicial for the society's wellbeing.

Finally, we calibrate the model and illustrate how lobbying may influence the long-run performance and welfare of the U.S. economy. For our benchmark calibration, the model predicts that lobbying may have resulted in a long-run growth rate about .4 percentage points higher than the one that would prevail under free-entry, with a positive repercussion in aggregate welfare. We critically evaluate one of the main simplifying assumptions of the model, which is crucial to determine the welfare change, and numerically adapt the model to contemplate an alternative, more realistic, approach. Under this modified scenario, we conclude that welfare might have increased as a result of lobbying, but an increase in the intensity of lobbying may result in prejudicial effects for the society.

## Related literature

Our work is related to a growing literature that discusses the effects of rent-seeking on economic performance, including Krusell and Rios-Rull (1996); Parent and Prescott (1994) and Murphy et al. (1991).[10] In particular, Angeletos and Kollintzas (2000) and Blackburn and Forgues-Puccio (2007) analyze the effects of rent-seeking on economic growth, but impose a constant market structure, and rely on the standard rent-seeking technology (black-box approach) to model the interaction between economic agents. Brou and Ruta (2007) introduce an endogenous market structure, but their results depend on a rent-seeking technology modeled in the wrong direction, *i.e.*, where firms lobby the government in exchange for contributions, which are

[10] Other interesting references include Bellettini and Ottaviano (2005); Murphy et al. (1993) and Olson (1982).

financed by taxing consumers. This structure makes unclear what they are trying to explain. Since the government is a key agent in their framework, lobbying would be a good candidate, however it is difficult to come up with examples where the government itself taxes consumers in order to provide firms with contributions, in exchange for lobbying activities which source cannot be identified by any means. Besides, the government in their model is nothing more than a mechanical being, who allocates money to firms through an exogenous command which translates their rent-seeking efforts. It is our opinion that such a model completely neglects the sources driving economic performance, as agents' interplay is a key factor in understanding and developing such analysis.

It is our objective to cover this gap in the literature, presenting a model where market structure is considered a key factor in economic analysis, and where the interaction between players is explicitly taken into account. We shall therefore proceed our analysis as follows. The next section presents the benchmark model. Section 3 presents the free-entry *laissez-faire* equilibrium – our benchmark case. Section 4 introduces lobbying and presents the main results of the paper. In section 5 we undertake a calibration exercise. Section 6 concludes.

# 2 Benchmark model

## 2.1 Characterization

The model is set in continuous time. We take the (closed) economy to be populated by a mass of $L$ infinitely-lived and identical consumers; each of whom supplies inelastically one unit of labor and seeks to maximize the present value of the logarithm of consumption. Besides consumers, the economy is composed by $N > 1$ oligopolistic firms;[11] each of whom supplies one differentiated good using the available technology, and invests in Research and Development (R&D) in order to improve its state-of-the-art product.[12]

[11]In the main analysis, we consider the number of firms, $N$, as a discrete variable, since our results below rely on strategic interaction between firms. However, in some steps $N$ will be treated as a continuous variable, since this greatly simplifies the algebra of the model.

[12]Contrary to Peretto (1996, 1998) and Brou and Ruta (2007), who consider cost-reducing technological progress, here we assume that firms invest in quality improvements over their state-of-the art product. These two specification are, however, formally equivalent (Spence, 1984; Tirole, 1988), so that rewriting the model in terms of cost-reducing technological progress yields exactly the same results.

### 2.1.1 The demand side: consumer behavior

The typical household seeks to maximize lifetime utility[13]

$$u(t) = \int_t^{\infty} \log\big(C(\tau)\big) \cdot e^{-\rho(\tau-t)} \mathrm{d}\tau$$

subject to the usual intertemporal budget constraint

$$\int_t^{\infty} E(\tau) \cdot e^{-R(\tau)} \mathrm{d}\tau \leq \int_t^{\infty} \big[w(\tau) + D(\tau) + T(\tau)\big] \cdot e^{-R(\tau)} \mathrm{d}\tau + A(t)$$

Here, $\rho > 0$ denotes the discount factor and $R(\tau) = \int_t^{\tau} r(s)\mathrm{d}s$ is the average interest rate from time 0 to time $\tau$. The terms $D$ and $A$ represent per capita dividends and assets, respectively, while $w$ stands for the wage rate. The term $T$ designates per capita lump-sum transfers from the policy-maker.[14] Finally, $E$ denotes per capita expenditure and $C$ stands for consumption. Let $P_C$ denote the price index of consumption, with the following property

$$E = P_C \cdot C \tag{1}$$

Using (1), the intertemporal maximization problem can be readily solved, yielding the usual first-order condition

$$\frac{\dot{E}}{E} = r - \rho \tag{2}$$

Consumers aggregate intermediate goods, $x_i$, characterized by the state-of-the-art quality index, $q_i$, in a consumption bundle according to the Dixit and Stiglitz (1977) specification[15]

$$C = \left[ \sum_{i=1}^{N} \big(q_i \cdot x_i\big)^{\frac{\varepsilon-1}{\varepsilon}} \right]^{\frac{\varepsilon}{\varepsilon-1}} \tag{3}$$

where $\varepsilon > 1$ is the elasticity of substitution between two different varieties. Note that expenditures can alternatively be written as

$$E = \sum_{i=1}^{N} p_i \cdot x_i \tag{4}$$

[13] A logarithmic specification allows us to keep the model more tractable, without bringing any substantial qualitative changes to the results discussed in the paper, if compared to the more general case of a constant elasticity of intertemporal substitution.

[14] This term will only be relevant in the political market, and therefore its role is described in greater detail therein.

[15] We are implicitly assuming that new goods render the obsolete versions useless, so that households only obtain utility from the state-of-the-art product.

Given the time path of expenditures in (2), the individual demand schedules can be found by maximizing (3), pre-multiplied by the price index $P_C$, subject to (4), yielding: $x^D(p_i, q_i) = ES(p_i, q_i)/p_i$, where the new term,[16]

$$S(p_i, q_i) = \frac{p_i^{-(\varepsilon-1)} q_i^{(\varepsilon-1)}}{\sum_{j=1}^{N} p_j^{-(\varepsilon-1)} q_j^{(\varepsilon-1)}}$$

represents the market share captured by firm $i$. As consumers are identical, the demand faced by each firm is

$$X^D(p_i, q_i) = \frac{LES(p_i, q_i)}{p_i} \tag{5}$$

For later reference, let us keep in mind that the price elasticity of demand is

$$\xi(p_i, q_i) = -\frac{\mathrm{d}X_i^D}{\mathrm{d}p_i}\frac{p_i}{X_i^D} = \varepsilon - (\varepsilon - 1)S(p_i, q_i) \tag{6}$$

and the quality elasticity of demand can be described as

$$\zeta(p_i, q_i) = \frac{\mathrm{d}X_i^D}{\mathrm{d}q_i}\frac{q_i}{X_i^D} = (\varepsilon - 1)\big(1 - S(p_i, q_i)\big) \tag{7}$$

### 2.1.2 The supply side: technology

Each firm produces output with technology

$$L_{X_i} = X_i + \phi \tag{8}$$

where $X_i$ is the total output produced by firm $i$ and $L_{X_i}$ is labor used in production. The parameter $\phi > 0$ is a fixed and sunk cost of production, which can be interpreted as the labor required to keep the firm running.

The firm's quality stock, $q_i$, which determines the quality embedded in the state-of-the-art product, is directly related to the firm's knowledge, $z_i$. To be more specifically, we consider that a level of knowledge of $z_i$ units generates a quality index of

$$q_i = z_i^{\theta}$$

where $\theta$ is the elasticity of quality with respect to R&D investment. The parameter $z_i$ evolves according to

[16] From this problem, we can also obtain the price index of consumption

$$P_c = \left(\sum_{i=1}^{N} p_i^{(1-\varepsilon)} q_i^{-(1-\varepsilon)}\right)^{\frac{1}{1-\varepsilon}}$$

$$\dot{z}_i = L_{z_i} \cdot \left[ z_i + \gamma \sum_{j \neq i}^{N} z_j \right] = L_{z_i} \cdot Z_i \tag{9}$$

where $\dot{z}_i$ is the number of new patents produced in $\mathrm{d}\tau$ units of time by a firm employing $L_{z_i}$ units of labor in R&D. The specification in (9) considers that the productivity in the R&D sector is a linear combination of both private and public knowledge, with $\gamma \in (0,1)$ determining the share of private research that becomes publicly available. To make an analogy with some traditional literature on quality-ladder models,[17] we can think that, when an innovator brings a new product into the market, researchers can costlessly disassemble and study all its attributes, and this knowledge can be readily used by firms to develop new blueprints, increasing the productivity of R&D by $\gamma$.

The term $Z_i = \left( z_i + \gamma \sum_{j \neq i}^{N} z_j \right)$ is introduced to shorten notation, and represents total productivity of a firm investing $L_{z_i}$ units of labor in R&D. Finally, notice that the technology in (9) exhibits overall increasing returns to scale and constant returns to scale in knowledge.[18]

#### 2.1.3 Defining industry equilibrium

Since lobbying plays a crucial role in determining the equilibrium number of firms and consequently equilibrium growth and welfare, we need to establish the concept of equilibrium both under *laissez-faire* and with lobbying. Our analysis here will be restricted to a symmetric equilibrium, since this makes the model more tractable and conveys the main intuition more clearly as compared to the asymmetric case. Hence, we assume, as in Peretto (1996), that knowledge diffuses across firms as workers move from one firm to the other. Since incumbent firms accumulate knowledge at equal rates, all workers have the same level of expertise, and therefore new entrants are able to acquire this knowledge by hiring workers from existing firms. Alternatively, we can think that entrants are able to learn costlessly all the characteristics of any existing good and do not need any additional effort to set up their R&D at the average quality of the market. Finally, a normalization is needed in order to setup the roots of the model, and therefore we fix $q_i(t) = 1$, $\forall\, i$.

Let us first consider the definition of industry equilibrium under *laissez-faire*, *i.e.*, where the government has no influence over the market structure. To simplify the analysis, we assume that firms can enter and exit the market costlessly. Individual optimization requires that firms maximize their stock market value, $V_i$, through the choice of a pricing strategy, $p_i$, and a R&D strategy, $L_{z_i}$, taking as given the number of competitors and the price of labor. Once this behavior is established, entry and exit decisions based on

[17] See, for example, Grossman and Helpman (1991).

[18] See Peretto (1996) for a brief discussion on this technology.

individual profitability conditions within the market determine the number of active firms.

More formally, let $s_i = [p_i(\tau), L_{z_i}(\tau)]$, $\tau \geq t$ be the strategy vector played by firm $i$, and define $\mathbf{s} = [s_1, \ldots, s_N]$. Then,

**Definition 1.** *The vector* $[\mathbf{s}, N]$ *is an instantaneous equilibrium with free-entry and exit (no lobbying) if for all* $i$*:*

$$V_i(s_i, \mathbf{s}_{-i}, N) \geq V_i(s_i', \mathbf{s}_{-i}, N)$$

*and, for all* $N > 1$*,*

$$V_i(s_i, \mathbf{s}_{-i}, N) \geq 0 \geq V_i(s_i, \mathbf{s}_{-i}, N+1)$$

The first of these conditions implies precisely that the behavior of firms is optimal, *i.e.*, profit maximizing, given the market structure and the strategy vectors of all other firms. The second condition establishes that entry/exit from the market is driven by profitability conditions that arise within it.

Once lobbying is taken into account, politicians may influence the determinants of market structure, ultimately defining the number of active firms in the economy. The policy-maker sets the number of firms, $N$, so as to maximize his objective function, which is a weighted average of the representative consumer's welfare, $U(N)$, and the total amount of contributions, $\Omega(N)$, with a weight of $\lambda$ placed on the latter.[19] More formally, we have

**Definition 2.** *The vector* $[\mathbf{s}, N]$ *is an instantaneous equilibrium with lobbying if for all* $i$*:*

$$V_i(s_i, \mathbf{s}_{-i}, N) \geq V_i(s_i', \mathbf{s}_{-i}, N)$$

*and, for all* $N, N' > 1$*,*

$$(1-\lambda) \cdot U(N) + \lambda \cdot \Omega(N) \geq (1-\lambda) \cdot U(N') + \lambda \cdot \Omega(N')$$

*where,*

$$N, N' \in \{x \in \mathbb{N} : \ V_i(s_i, \mathbf{s}_{-i}, x) \geq 0 \ \forall i\}$$

The first condition is the same as for the case with no lobbying. The second and third conditions state that the policy-maker chooses a market structure among all feasible alternatives (which imply no economic loss for firms), in order to satisfy his objective function.[20]

[19] In our setup, as all individuals are identical, the utility of the representative individual can be thought of as the utility of the median voter.

[20] According to this definition, even a benevolent politician with $\lambda = 0$ may want to induce a change in the market structure, selecting a lower number of firms than determined by the zero-profit condition. The reason is that the utility of the representative individual, $U(N)$, does not need to be increasing in its argument, and hence higher welfare may be attained through a reduction in the number of firms. We return to this issue later.

This formulation is common in the literature, and intends to capture the intuition that both popular policies and money are needed to win elections. Austen-Smith (1987), for example, argue that policy-makers may be willing to move away from the preferred policy-vector by voters in order to increase campaign contributions, as these can be used to influence voters perceptions about candidates' positions (either through media and political debates, or by increasing the collection of information), therefore shaping the electoral outcome. Grossman and Helpman (1996) use a model of electoral competition and distinguish between informed voters, who are able to understand and evaluate parties programmes and characteristics, and uninformed or impressionable voters, who are not able to evaluate parties positions and therefore are highly responsive to campaign spending. In this context, they show that the above specification captures quite well political decision-making when candidates seek to maximize the fraction of total votes in the legislature.[21]

In our model, if the weight given to contributions, $\lambda$, is sufficiently high, then a more restrictive market structure can create profitability conditions that free-entry would otherwise eliminate, possibly inducing an equilibrium with positive contributions to the government and positive profits for the firms.

## 2.2 The economic market

In this subsection, we analyze the economic decisions of firms, as well as the growth rate and welfare, for a given market structure.

### 2.2.1 The firm's problem

Firms simultaneously and non-cooperatively maximize the net present value of cash flows,

$$V_i(t) = \int_t^{\infty} \pi_i(\tau) \cdot e^{-R(\tau)} \mathrm{d}\tau, \tag{10}$$

where instantaneous profits are

$$\pi_i = p_i \cdot X^D(p_i, q_i) - w \cdot (L_{X_i} + L_{z_i}),$$

through the choice of a price strategy and R&D expenditure, subject to the technological constraints (8) and (9), and total demand (5), taking as given the number of firms, and the competitors' pricing strategies and R&D investments. The Current Value Hamiltonian is

[21]More recently, Rodríguez (2004) used a similar structure to model a bargain between capitalists and the government, which leads to a negative relationship between redistribution and inequality.

$$H_i^{cv} = (p_i - w) \cdot \frac{LES_i}{p_i} - w \cdot (L_{z_i} + \phi) + \mu_i \cdot L_{z_i} \left[ z_i + \gamma \sum_{j \neq i}^{N} z_j \right],$$

where the co-state variable, $\mu_i$, measures the value of a marginal unit of knowledge, *i.e.*, the value of the patent. The firm's knowledge capital, $z_i$, is the state variable, and R&D investment, $L_{z_i}$, and the price, $p_i$, are the control variables. As this economy lacks a monetary unit, we take the wage rate as numeraire and measure all variables in terms of $w$. Without loss of generality, consider that $w = 1$ henceforth.

As the decision regarding the price level is not associated to any dynamic constraint, it follows immediately that the optimal Nash-Bertrand price strategy is

$$p_i = \frac{\xi_i}{\xi_i - 1} \tag{11}$$

where $\xi_i$ is the price elasticity of demand defined in (6). The optimal R&D strategy implies that the marginal revenue from one unit of R&D matches its marginal cost, *i.e.*[22]

$$1 = \mu_i \cdot \left[ z_i + \gamma \sum_{j \neq i}^{N} z_j \right] = \mu_i \cdot Z_i \tag{12}$$

The differential equation in the co-state variable yields the no-arbitrage condition

$$r = \theta \frac{p_i - 1}{p_i} \cdot \frac{LES_i}{z_i} \cdot \frac{\zeta_i}{\mu_i} + L_{z_i} + \frac{\dot{\mu}_i}{\mu_i}, \tag{13}$$

where $\zeta_i$ is the quality elasticity of demand in (7). Equation (13) states that the rate of return of a riskless asset equals the return of the R&D project undertaken by the firm. Using the price strategy (11) and condition (12), this simplifies to

$$r = \theta \cdot LE \cdot S_i \cdot \frac{\zeta_i}{\xi_i} \cdot \frac{Z_i}{z_i} + L_{z_i} + \frac{\dot{\mu}_i}{\mu_i} \tag{14}$$

Finally, we close this section by presenting the transversality condition,

$$\lim_{\tau \to \infty} \mu_i(\tau) \cdot z_i(\tau) \cdot e^{-R(\tau)} = 0$$

which states that, at the end of the planning horizon, the firm's knowledge has no value.

[22] Throughout the analysis, we implicitly assume that this problem yields an interior solution, *i.e.* $L_{z_i} > 0$. We do not deal directly with situations where this condition is violated.

### 2.2.2 The symmetry property

In this paper we focus on the symmetric equilibrium. Let the variables without subscripts represent industry averages. Then, the quality stock evolves over time according to

$$\frac{\dot{q}}{q} = \theta \cdot \frac{\dot{z}}{z} = \theta \cdot \sigma(N) \cdot L_z, \tag{15}$$

where the new term $\sigma(N) = [1 + \gamma(N-1)]$ represents the productivity of a R&D project applying one unit of labor. Note that $\sigma(N)$ is increasing in $N$, reflecting the positive impact of publicly available knowledge on R&D productivity. Following our previous notation, $Z = \sigma(N) \cdot z$, and hence we have[23]

$$\frac{\dot{Z}}{Z} = \frac{\dot{z}}{z} \tag{16}$$

Differentiating equation (12) with respect to time, using conditions (15) and (16), and the facts $Z/z = \sigma(N)$ and $S = 1/N$ in a symmetric equilibrium, the no-arbitrage condition (14) reduces to[24]

$$r = \frac{LE}{N\xi} \cdot \theta\zeta \cdot [1 + \gamma(N-1)] - \gamma \cdot (N-1) \cdot L_z \tag{17}$$

where the price and quality elasticities of demand are respectively,

$$\xi = \varepsilon - (\varepsilon - 1)\frac{1}{N} \qquad \text{and} \qquad \zeta = (\varepsilon - 1)\frac{N-1}{N}$$

Equation (17) allows us to identify the determinants driving average R&D investment, and consequently economic growth. The term $\frac{LE}{N\xi}$ represents the *gross-profit effect*, and is simply the gross profit of the firm for a given market share. The term $\theta\zeta$ is the *business-stealing effect*, and captures the increase in market share due to quality increasing R&D.[25] Spillovers also have two distinct effects over R&D productivity, working on opposite directions. On one hand, firms realize that their own R&D will generate spillovers, which will make their competitors more productive. This is captured by the term $-\gamma \cdot (N-1)$. On the other hand, firms also benefit from the spillovers of

[23]Without lobbying, the free-entry condition determines the number of firms at each moment in time. Profitability conditions inside the market are instantaneously eliminated by costless entry/exit, implying $\dot{N} = 0$ at all times. With lobbying, the active number of firms responds immediately to the number of R&D licences made available by the policy-maker, so that $\dot{N} = 0$ at all times.

[24]In order to avoid some cumbersome notation, we emphasize the dependence of $N$ in some variables only when it is relevant for the analysis or discussion.

[25]This terminology is based on Peretto (1996, 1998). A more detailed discussion about these effects can be found here.

other firms, which contribute positively to their productivity, by the amount $\gamma(N-1)$.

Observe that equation (17) can be rewritten as

$$L_z(N,E,r) = \frac{1}{\gamma}\left[\theta\zeta(N)\cdot\frac{LE}{N\xi(N)}\cdot\frac{\sigma(N)}{(N-1)} - \frac{r}{N-1}\right] \tag{18}$$

delivering the optimal individual investment in R&D as a function the number of firms, $N$, aggregate demand, $LE$, and the interest rate, $r$. Average R&D in (18) is endowed with a very special property: it is hump-shaped in the number of firms, $N$.[26] The intuition is quite simple. While the *gross-profit effect* implies that the returns to R&D are decreasing in $N$, since a higher number of firms entails both a decrease in the market share and in the markup, which are translated into lower profits and consequently lower incentives to invest in quality upgrades, the *business-stealing effect* implies that firms are willing to invest more as $N$ increases, as the potential gain in market share due to R&D becomes higher. The *business-stealing effect* should dominate when there are few firms, as the total amount of market profits that can be appropriated through R&D is higher, while the *gross-profit effect* should predominate when $N$ is large, because the amount of profits that can be captured through quality improvements becomes lower. Spillovers have a second order effect over $L_z$. When concentration is maximal, the *business-stealing effect* approaches zero, and no R&D is undertaken, regardless of spillovers. On the other hand, in a monopolistically competitive market, the positive and negative effect of spillovers tend to cancel each other out, and the *gross-profit effect* defines the limiting behavior of average R&D.

Aggregate R&D, $\mathbf{L}_z(N,E,r) = NL_z(N,E,r)$ is also hump-shaped in $N$, due to the *dispersion effect.* As the number of firms grows large, R&D resources are being spread across too many firms; firms become unable to exploit economies of scale in the R&D lab and push down their investments in product development. As the reduction in average R&D eventually offsets the increase in the number of R&D projects in the economy, $\mathbf{L}_z$ goes down.

Finally, in a symmetric equilibrium instantaneous profits reduce to

$$\pi(N,E,r) = \frac{LE}{N\xi(N)} - (L_z(N,E,r)+\phi) \tag{19}$$

## 2.3 Growth and welfare

### 2.3.1 Growth

The growth rate in this economy is determined by the growth rate of consumption. Plugging in $x = E\cdot(\xi-1)/(N\xi)$ in the consumption index (3),

[26] Although this is not true for all possible parameter values, intuitively this is the more relevant situation to consider. In what follows, we confine ourselves to this case.

taking the logarithm and simplifying, we obtain

$$\log C(\tau) = \frac{1}{\varepsilon - 1} \log N + \log \frac{\xi(N) - 1}{\xi(N)} + \log q(\tau) + \log E(\tau) \tag{20}$$

Differentiating the above equation with respect to time yields

$$g(N, E, r) = \theta \frac{1 + \gamma(N-1)}{N} \cdot \mathbf{L}_z(N, E, r) + r - \rho \tag{21}$$

which gives us the growth rate as a function of the number of firms in the market, $N$, aggregate expenditures, $LE$, and the interest rate, $r$. In this economy, growth depends on how the average quality of all available brands evolves through time and on the usual intertemporal trade-off faced by consumers. Note the difference between these two sources of growth: the former is based on quality improvements, which enable consumers to appropriate larger benefits from existing products; the latter is just the outcome of the intertemporal decision of consuming today versus delaying consumption to some future date, and is not associated to any intrinsic expansion of the consumption basket.

Before proceeding, it is worth noting the determinants of average quality growth. The term $1 + \gamma(N - 1)$ captures the productivity of one unit of labor in an R&D project undertaken by the average firm, and is composed of two effects: the direct effect of the project on the quality of the product developed by the firm, and the indirect effect of the project over the overall stock of knowledge available to other firms, which enable them to become more productive and increase the quality of their products faster. This latter effect is increasing in $N$, since a higher number of firms allows the economy to appropriate a larger amount of spillovers. The term $\mathbf{L}_z/N$ captures the resources applied to improve the average brand of the economy. Since $\big(1 + \gamma(N - 1)\big)/N$ converges to a lower bound $\gamma$, the growth rate is also hump-shaped in the number of firms.

For illustrative purposes, it will be useful later to represent the economy's growth rate as a function of the complement of the Lerner Index (hereinafter $\bar{l}$). Noting that the Lerner Index ($l$) is simply the inverse of the elasticity of demand, *i.e.* $l = \xi(N)^{-1}$, the relationship between the number of firms and $\bar{l}$ can be expressed as $N = \xi^{-1}(1/\bar{l})$, or equivalently[27]

$$N = \frac{(1 - \bar{l})(\varepsilon - 1)}{(1 - \bar{l})\varepsilon - 1} \tag{22}$$

[27]Observe that as $N$ converges to infinity, $l$ converges to the lower bound $1/\varepsilon$. There is always some market power, as the Lerner Index cannot fall below this value. Moreover, we use the complement of the Lerner Index only because this measure depends positively on the number of firms, which is convenient for the subsequent analysis. It follows that all the properties of the economy derived as a function of $N$ can immediately be also described as a function of $\bar{l}$, with no need of further adjustments.

Using this identity in (21), we obtain the relationship between growth and a convenient measure of market concentration, $g(\bar{l}, E, r)$, as illustrated in appendix A.1. We will often use this relationship without explicitly mentioning it to go from the Lerner Index to the number of firms and *vice-versa*.

### 2.3.2 Welfare

The lifetime utility of the representative individual as a function of $N$ and the general equilibrium variables $E$ and $r$ is

$$U(N, E, r) = \frac{1}{\rho}\left[\frac{1}{\varepsilon - 1}\log N + \log\frac{\xi(N) - 1}{\xi(N)} + \frac{g(N, E, r)}{\rho} + \log E\right] \quad (23)$$

which can also be expressed as a function of $\bar{l}$, $U(\bar{l}, E, r)$, using identity (22). Equation (23) captures three effects through which a decrease in market concentration affects welfare.[28] The first is a pure variety effect – a larger number of varieties makes consumers better off, due to the enlargement in the set of available options. The second is a competition effect, which captures the decrease in the markup price following a less concentrated market structure. Finally, the growth rate determines the increase in the flow utility over time. It follows that the utility above does not need to be positively related to $N$. As the growth rate is hump-shaped in the number of firms, an increase in the number of brands for large $N$ may induce a reduction in aggregate R&D capable of overcoming both the gains obtained through a larger number of varieties and a lower price level.

In order to emphasize the true effects of political contributions over welfare and growth in the general equilibrium framework, it is convenient to assume that the utility function in (23) is strictly increasing in $N$, since this will induce a *laissez-faire* equilibrium which is welfare maximizing. This should not be seen as a restriction imposed upon the model; rather its main role is to strengthen our argument, by illustrating how lobbying is able to increase welfare over a welfare maximizing free-entry (general) equilibrium.[29] We therefore postulate the following:

**Assumption.** *The utility function represented in equation* (23) *is* increasing *in the number of varieties, $N$, for a given level of expenditures, $E$.*

[28] In what follows, we use the terms utility and welfare interchangeably where it leads to no confusion to refer to equation (23).

[29] This assumption captures Romer's (1994) observation that the decrease in the number of available varieties following exit from the market may have a determinant impact over welfare. Our calibration results, presented in section 5, also suggest a positive relationship between the number of firms and individual utility.

# 3 Equilibrium with no lobbying: the benchmark case

## 3.1 Industry equilibrium

In the absence of lobbying activities, and with entry and exit costs equal to zero, the equilibrium number of firms is a jumping variable that satisfies the free-entry condition at all time.[30] In particular, whenever $V > 0$ there is entry, whereas for $V < 0$ there is exit. Differentiating equation (10) with respect to time an rearranging, we obtain the following perfect-foresight, no arbitrage condition for the equilibrium in the capital market

$$rV = \pi + \dot{V}$$

This equation, together with the free-entry condition, $V = 0 \; \forall \tau$, implies that instantaneous profits, $\pi(N, E, r)$, must equal zero at all time.[31] Making use of (19), this can be summarized as

$$\frac{LE}{N\xi(N)} = L_z(N, E, r) + \phi \tag{24}$$

which determines the number of firms in the market as a function aggregate expenditures, $LE$, and the interest rate, $r$, and where $L_z$ is given by (18). Let the solution to (24) be denoted by $N^f(E, r)$. Aggregate R&D, as a function of the general equilibrium variables, simplifies to

$$\mathbf{L}_z\big(N^f(E, r), E\big) = \frac{LE}{\xi\big(N^f(E, r)\big)} - N^f(E, r) \cdot \phi \tag{25}$$

## 3.2 General equilibrium

In order to find the equilibrium growth rate, it remains to impose two general equilibrium requirements – the first-order condition from consumers intertemporal optimization problem, and the labor market clearing condition. Together, these enable us to recover per capita expenditures and the interest rate. Observe that the labor market clearing condition implies

$$N^f(E, r) \cdot L_X\big(N^f(E, r), E\big) + \mathbf{L}_z\big(N^f(E, r), E\big) = L \tag{26}$$

where $\mathbf{L}_z\big(N^f(E, r), E\big)$ is defined in (25) and

$$L_X\big(N, E\big) = LE \cdot \frac{\xi(N) - 1}{N\xi(N)} + \phi \tag{27}$$

[30] For analytical convenience, the rest of the analysis treats the number of firms as a continuous variable. See Brou and Ruta (2007) and Peretto (1996) for a discussion on this issue.

[31] Consequently, dividends in the consumers budget constraint must also be zero.

After some algebra, (26) reduces to $E^f = 1$, and it follows that, in equilibrium, $\dot{E}/E = 0$. Finally, joining (18) with (24), using the expression for $\zeta(N)$ and the facts that $r = \rho$ and $E^f = 1$, we obtain the equilibrium number of firms under free-entry, denoted by $N^f = N^f(E^f, \rho)$, as the solution to[32]

$$\frac{L}{N^f \xi(N^f)} \left[ 1 - \frac{\theta(\varepsilon - 1)\sigma(N^f)}{\gamma \cdot N^f} \right] + \frac{\rho}{\gamma \cdot (N^f - 1)} = \phi \tag{28}$$

from which we can also obtain $\bar{l}^f = \big(\xi(N^f) - 1\big)/\xi(N^f)$.

### 3.3 Equilibrium growth and welfare

The equilibrium growth is obtained after replacing $N$, $E$ and $r$ in equation (21) by their equilibrium values. Letting $\mathbf{L}_z^f = \mathbf{L}_z(N^f, E^f)$, the equilibrium growth rate in this economy under *laissez-faire* becomes

$$g^f = \theta \cdot \frac{1 + \gamma(N^f - 1)}{N^f} \cdot \mathbf{L}_z^f$$

Finally, welfare in equilibrium is

$$U^f = \frac{1}{\rho} \left[ \frac{1}{\varepsilon - 1} \log N^f + \log \frac{\xi(N^f) - 1}{\xi(N^f)} + \frac{g^f}{\rho} \right]$$

In general, $g^f$ does not define the maximum growth rate, since an increase in market concentration might be able to foster growth. However, the equilibrium number of firms is clearly welfare maximizing, since it provides consumers with the best mix of growth, prices and varieties, within the set that allows firms to have non-negative profits, given the general equilibrium conditions (refer to appendix A.2 for a graphical representation). From here onwards, we only consider the case where the free-entry outcome is associated to a market concentration which lies below the one required to maximize the growth rate, so that a reduction in the number of firms, *ceteris paribus*, always increases growth. This is the most realistic case to consider, as we note in the calibration section later on.

[32] Equation (28) does not need to define a unique stable market structure; in fact, a market equilibrium with positive levels of R&D may be sustained for more than one value of $N^f$. In what follows, however, we abstain from these issues, which unnecessarily complicate our analysis, and take the above equation to define a unique stable market structure.

# 4 Lobbying and the political market

## 4.1 Introducing lobbying

We now turn to the effects of lobbying over market structure, growth, and welfare. Since the policy-maker is usually seen as a monopolist over R&D licences, we assume, with no loss of generality, that he is able to define the market structure directly. This approach can be motivated in at least two different ways. In the first, firms compete among themselves for R&D licences, presenting politicians with cash transfers in order to influence decision-making in their favor. The policy-maker therefore chooses the active number of firms, taking into account the total profitability of the market, since this influences the level of contributions he is able to extract in equilibrium. In the second, firms associate among themselves and create a lobby, who presents politicians with in-kind or campaign contributions, or any other form of political contributions, from its members, in exchange for a more restrictive R&D policy which enhances the profitability of the market. In this latter case, firms and politicians engage in a bargain over a market structure and an amount of contributions that makes all players (weakly) better off.[33] In the model we develop, the former interpretation can be seen as a special case of the latter, with a completely asymmetric distribution of surplus in the benefit of the policy-maker. Hence, and again with no loss of generality, throughout the remaining analysis we focus on the second of these interpretations.[34]

Politicians are purely office motivated, but they realize that money can be used to capture votes, either through propaganda or media debates, or simply by signaling voters their ability to raise funds. We capture this behavior through a widely used specification where the policy-maker maximizes a weighted sum of society's welfare and political contributions, as stated in definition 2. These weights are a simple shortcut to represent more complex scenarios as, for example, political transparency or the level of democracy (Aghion et al., 2007), the number of uninformed voters who are highly responsive to campaign expenditures (Baron, 1994; Grossman and Helpman, 1996), or the number of swing voters who are highly responsive to changes

[33] Although this negotiation can induce exit from the market, the best alternative available to firms is the one conveyed by the free-entry outcome, which has the same economic value as the former. Hence, lobbying can make no firm worse off.
Moreover, note that, since firms are owned by consumers, it is in fact consumers who ultimately lobby the government. An increase in concentration results in positive dividends and transfers, which allows consumers to expand the amount of goods they can afford for the same price level.

[34] We do not provide a theory of lobbying formation here. We simply assume that firms are able to overcome their rivalry and get organized in order to improve their bargaining power, ignoring any issues that might be induced by the possibility of free-riding. We can think that firms not represented in the lobby cannot obtain licences from the policy-maker or face larger difficulties in obtaining these licences, due to a lack of bargaining power.

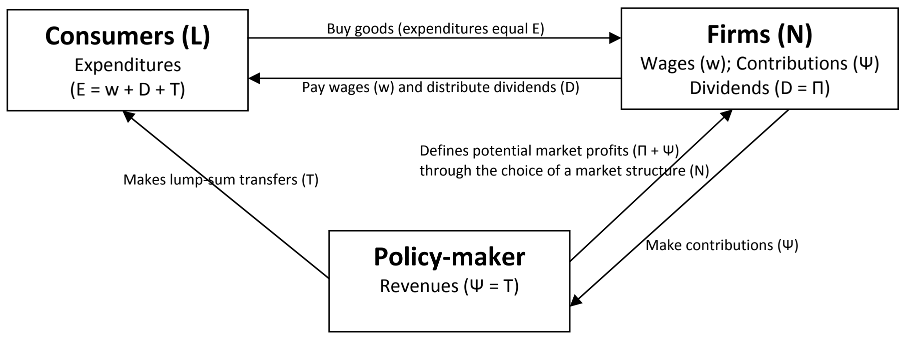


Figure 2: Venn diagram with the interaction between economic agents.

in platforms by political parties (Person and Tabellini, 2000).

We consider that the policy-maker distributes the proceeds from contributions back to households through lump-sum transfers, represented by $T$ in the consumer's budget constraint. Otherwise, the existence of equilibrium would require that agents would be able to run Ponzi schemes forever, since expenditures would exceed income at all times.[35] A way to think of this assumption is that the policy-maker does not extract direct benefits from political contributions, but only from holding office, and therefore he redistributes them back to consumers in order to influence his prospects of election. Figure 2 summarizes the interactions between agents in this economy.

If we take the temporal horizon of politicians to be the same as the remaining economic agents,[36] and assume an identical discount factor, the utility of the policy-maker is

$$u^{pol}(t) = (1-\lambda)\int_t^{\infty} \log\big(C(\tau)\big)\cdot e^{-\rho(\tau-t)}\mathrm{d}\tau + \lambda\int_t^{\infty} \Psi(\tau)\cdot e^{-\rho(\tau-t)}\mathrm{d}\tau \quad (29)$$

where $\Psi(\tau) \geq 0$ is the total amount of instantaneous contributions and $C(\tau)$ is households consumption, at time $\tau$. To keep the model tractable, in what follows we only consider contribution schedules that are steady over time, *i.e.*, $\Psi(\tau) = \Psi$. We will be more specific about $\Psi$ latter on. The first part of (29) is the utility of the representative individual given the number of

[35] The relevant point of this assumption is that political contributions must be spent on goods produced in the economy. Alternatively, we could have assumed that the policy-maker used the income from contributions to buy goods from firms. This, however, provides an additional complication in the model, without bringing any substantial insights to our theoretical discussion. In the calibration section, we specifically discuss, in the context, the role of this alternative specification, and analyze how it affects the results.

[36] If we think that parties present a significative role in defining the relevant policies, then this assumption is not totally unrealistic. The market structure follows a continuous negotiation through time between parties and lobbyist firms, which overcomes the shorter temporal horizon of policy-makers.

firms and the general equilibrium conditions, as defined in equation (23), multiplied by the weight the policy-maker assigns to the welfare of voters, relative to political contributions.

### A reference case: the benevolent policy-maker

Let us consider first a benevolent policy-maker, who is solely concerned with the utility of the representative individual ($\lambda = 0$). He solves

$$\begin{aligned} \max_{N} \quad & \frac{1}{\rho}\left[\frac{1}{\varepsilon-1}\log N + \log\frac{\xi(N)-1}{\xi(N)} + \frac{g(N,E,r)}{\rho} + \log E\right] \\ \text{s.t.} \quad & \frac{LE}{N\xi(N)} - \big(L_z(N,E,r)+\phi\big) \geq 0 \end{aligned}$$

taking as given the general equilibrium variables of the economy, $E$ and $r$. Since $U(N,E,r)$ is increasing in $N$, the free-entry condition determines the equilibrium number of firms, as a function of aggregate expenditures and the interest rate. Hence, a benevolent policy-maker does not interfere with market forces, adopting a welfare maximizing *laissez-faire* policy. It follows that all the analysis developed previously can be used to characterize this economy. Crucially, note that, in the general equilibrium, growth is potentially below the maximum rate.

## 4.2 Industry equilibrium with lobbying

### 4.2.1 A simple model of lobbying with collusive bargaining

For a given the market structure, firms behave exactly as depicted in section 3, but now they realize that the industry equilibrium is not defined by the usual zero-profit condition. Instead, an equilibrium with positive profits can be sustained, as an R&D licence issued by the policy-maker is required to keep the firm running. The objective of this section is to present a simple model of lobbying where firms and policy-makers bargain over the amount of contributions and the number of R&D licences made available for firms to pursue their own economic activities. This process defines the industry equilibrium, given the general equilibrium variables $E$ and $r$.

More specifically, our focus lies on an efficient bargain, which makes all players (weakly) better off as compared to a *status-quo* market structure, $N^s$. An obvious candidate for $N^s$ is the equilibrium number of firms under free-entry, $N^f$, but more generally it can represent any active number of firms in the market prior to the bargain. Assume firms are able to get organized in a lobby, whose objective is to maximize the joint surplus of its members, and let $\Pi(N,E,r) = N \cdot \pi(N,E,r)$ denote aggregate profits, where $\pi$ is defined in (19). Then, the individual rationality constraints for the policy-maker and the lobby are, respectively

$$
\begin{aligned}
IR^P \quad &: \quad (1-\lambda)\cdot\big[U(N,E,r)-U(N^s,E,r)\big]+\lambda\cdot\frac{\Psi}{\rho}\geq 0\\
IR^F \quad &: \quad \frac{\Pi(N,E,r)-\Pi(N^s,E,r)}{\rho}-\frac{\Psi}{\rho}\geq 0
\end{aligned}
$$

In order for both to be satisfied, we must have

$$
\Psi\in\left[\frac{1-\lambda}{\lambda}\cdot\rho\left[U(N^s,E,r)-U(N,E,r)\right],\Pi(N,E,r)-\Pi(N^s,E,r)\right]
$$

This condition states that a successful bargain, which results in an increase in industry concentration, is only feasible if the policy-maker is largely concerned with political contributions relative to social welfare. Namely, a negotiation is feasible if and only if there exists a $N' < N^s$ such that[37]

$$
\frac{\lambda}{1-\lambda}>\rho\cdot\frac{U(N^s,E,r)-U(N',E,r)}{\Pi(N',E,r)-\Pi(N^s,E,r)} \tag{30}
$$

Otherwise, the *status-quo* outcome is implemented. If we take $N^s = N^f$, then the violation of condition (30) means that the policy-maker does not interfere in the market, and the outcome is as depicted for the *laissez-faire* equilibrium. The utility possibilities frontier is given by the solution to the following problem

$$
\begin{aligned}
\max_{\Psi,N} \quad & (1-\lambda)\cdot\big[U(N,E,r)-U(N^s,E,r)\big]+\lambda\cdot\frac{\Psi}{\rho}\\
\text{s.t.} \quad & \Pi(N,E,r)-\Pi(N^s,E,r)-\Psi=\overline{\Pi}\\
& \Pi(N,E,r)\geq 0\\
& N>1
\end{aligned}
$$

which states that agents will negotiate a market structure such that each surviving firm is left with a profit of $\overline{\Pi}/N > 0$, after contributions have been paid. Plugging in the first constraint into the objective function and defining $\lambda' = \lambda(1-\lambda)^{-1}$ as the relative weight of political contributions to social welfare in the policy-maker's utility function, the problem can be restated as

$$
\begin{aligned}
\max_{N} \quad & U(N,E,r)+\frac{\lambda'}{\rho}\cdot\big[\Pi(N,E,r)-\overline{\Pi}\big]\\
\text{s.t.} \quad & N\in[1,N^s]
\end{aligned} \tag{31}
$$

[37]Since our interest lies on cases where lobbying activities generate a decrease in the active number of firms, we confine ourselves to situations where $N^s > N'$.

Note that problem (31) is the same as maximizing the utility of the policy-maker represented in equation (29), after imposing the no growth condition on contributions and plugging in the relevant restrictions. For future convenience, let us redefine the utility of the politician as a function of the number of firms, $U^{pol}(N, E, r)$, as being equivalent to the objective function of the above problem.[38]

Observe that $U^{pol}(N, E, r)$ does not need to be strictly quasiconcave in $N$, and in fact imposing such condition turns out to be a too strong restriction on the model, mainly for the general equilibrium framework. Therefore, although we can always find a global maximum, the first-order condition that we provide below, alone, is not sufficient to characterize the negotiated market structure between the lobby and the policy-maker. We analyze the consequences of this issue in more detail later. Bearing these considerations in mind, the first-order condition for an interior solution, evaluated at the negotiated market structure, $\hat{N}^p$, is[39]

$$\left.\frac{\mathrm{d}U}{\mathrm{d}N}\right|_{N=\hat{N}^p} + \frac{\lambda'}{\rho} \cdot \left.\frac{\mathrm{d}\Pi}{\mathrm{d}N}\right|_{N=\hat{N}^p} = 0 \tag{32}$$

where $\hat{N}^p$ identifies the global maximum of problem (31)

$$U^{pol}\left(\hat{N}^p, E, r\right) \geq U^{pol}\left(\hat{N}, E, r\right),\ \forall \hat{N} \in [1, N^s] \tag{33}$$

Equation (32) defines the negotiated market structure, $\hat{N}^p = N^p(\lambda, E, r)$ (and the Lerner index) as a function of the general equilibrium conditions and the political weight given to contributions. It states that the policy-maker restricts the number of firms until the marginal sacrifice in individual utility matches the marginal gain from contributions. To put differently, the lobby undertakes political contributions in exchange for a more restrictive market structure that enhances the profitability of firms, and politicians effectively respond to these incentives, until the marginal benefit from additional contributions matches the marginal sacrifice in terms of households utility. Given $E$ and $r$, both players walk out of the bargain better off, at the expense of the inhabitants of the economy, despite the higher growth rate motivated by the increase in the level of gross profits. We can therefore put forward our first result:

**Result 1.** *In the partial equilibrium (or sectorial equilibrium), when compared to the perfect foresight* laissez-faire *general equilibrium, lobbying:*

*(i) increases market concentration;*

[38] We eliminated $U(N^s, E, r)$ and $\Pi(N^s, E, r)$ from (31), since these terms are constants, given $E$ and $r$, and therefore they do not affect the first-order condition below.

[39] For large values of $\lambda'$, the left hand side may be strictly positive for all values of $N$, and the problem in (31) yields a corner solution at $N = 1$. On the other hand, low values of $\lambda'$ imply $N = N^s$.

*(ii) raises the growth rate (except for values of $\lambda$ sufficiently close to one);*

*(iii) reduces individual welfare.*

This result is illustrated in figure 3. Starting from the perfect foresight general equilibrium under *laissez-faire*, the introduction of lobbying is able to foster growth, since a higher concentration increases the total amount of gross profits in the market that can be disputed through quality based R&D. However, consumers have a lower number of varieties available to construct their consumption index and face a higher price level. These two effects overcome the gains obtained from a higher growth rate, leading to a decrease in individual utility.

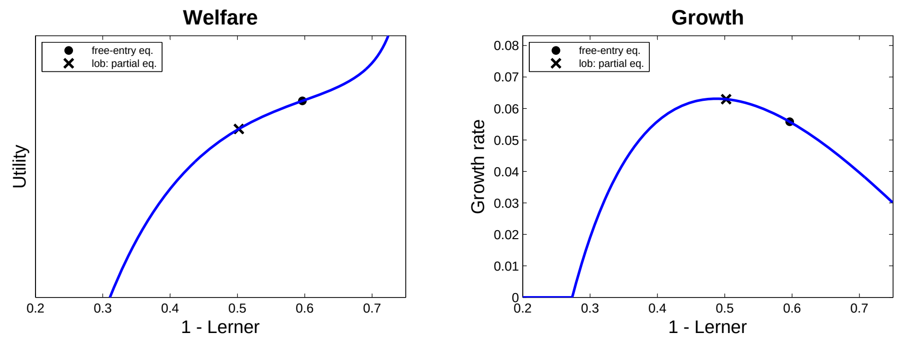


Figure 3: The effect of lobbying on growth and welfare in the partial equilibrium under assumption IU ($E = E^f$; $r = \rho$).

Note that the increase in the growth rate is only guaranteed for moderate values of $\lambda$, since a large preference for political contributions by the policy-maker generates an excessively concentrated market, in which there are little or no incentives to invest in product innovation. In particular, a fully voracious policy-maker ($\lambda$ converges to one) implements a monopolistic market structure. With a sole active firm in the market, there are no incentives to innovate, and the growth rate comes down to zero.[40]

Note additionally that the "partial equilibrium" result can be interpreted as a sectorial equilibrium, where lobbying activities undertaken by firms in a given sector have lead to a higher concentration in that industry and to a higher sectorial growth rate. Although the increase in market concentration obviously affects decisions, inducing an excess supply of labor, the resulting unemployment ends up being reflected only marginally throughout the remaining sectors of the economy, in which lobbying is not considered an issue. Hence, adjustments at the global level are negligible and result 1 could be considered a "final result."[41]

[40]This does not hold in the general equilibrium.

[41]Below we show that lobbying can never induce an excess demand for labor. This is critical to determine the general equilibrium adjustment that the economy will face.

### 4.2.2 The negotiated market structure: further insights

**Discontinuity of $N^p(\lambda, E, r)$**

The non-quasiconcavity of $U^{pol}(N, E, r)$ is a feature that arises only for certain parameter values, and it is materialized in the possible existence of multiple market structures that satisfy the first-order condition presented in (32). More specifically, it may originate up to two local maxima (besides a possible local minimum) in the objective function. However, the consequences of this technical issue also spread to the general equilibrium, since it may originate discontinuities in the labor demand when exogenous parameters are altered (and in particular when the level of expenditures change). For this reason, it is crucial to understand what originates such behavior.

First of all, observe that $U^{pol}(N, E, r)$ depends on the balance of the utility of the representative individual and overall profits, and there is no reason why this balance should be monotonic in the number of firms. For example, it may happen that a very low concentration scheme generates an amount of profits expressive enough to overcome the loss in welfare, originating a negotiated market structure which is locally optimal. A slight increase in the active number of firms can imply a quick dissipation of profits, depending on the fierceness of competition, instigating a reduction in the utility of the policy-maker, but when the number of firms in the market increases further, the responsiveness of aggregate profits with respect to the market size is reduced, and the gain in individual utility may now offset the decline in the amount of contributions received by the policy-maker, creating another locally optimal market structure. According to (33), the politician will select a market structure among the above which yields him the highest utility.

As the above balance is affected when exogenous parameters are altered, the selected number of firms may change discontinuously when these parameters vary, *i.e.* the global maximum may change its location.

**The effect of $\lambda$ and $E$**

We now analyze how the negotiated market structure changes with the preference for political contributions and with the level of expenditures.

**Preference for contributions ($\lambda$).** The negotiated market structure, $N^p(\lambda, E, r)$, is generally decreasing in the political weight given to contributions. The intuition is that a higher $\lambda$ makes contributions more important to the policy-maker, who will therefore increase concentration in the industry in order to appropriate larger profits in equilibrium. If $U^{pol}(N, E, r)$ is not quasiconcave, this decrease does not need to be continuous. Since the marginal change in profits is much more significant in highly concentrated markets, a sudden decrease in the active number of firms may be the optimal choice for the policy-maker.

**Individual Expenditures ($E$).** Additionally, $N^p(\lambda, E, r)$ is also decreasing in expenditures. The intuition is that an increase in $E$ enhances the level of gross profits in the market relative to the wage rate, our numeraire, which makes contributions more attractive, without compromising the objectives in terms of utility. Hence, a reduction in the number of firms allows the policy-maker to appropriate a larger share of profits, while refraining the decrease in utility due to a reduction in the number of varieties and to an escalation in prices with a higher growth rate. However, since an increase in $E$ has a much stronger impact over aggregate profits for low concentration schemes, as an excessive level of competition may lead firms to intensify their R&D activities in an attempt to appropriate such extra profits, making them to vanish very quickly, the policy-maker may opt for a sudden decrease in the active number of firms. In this way, he may appropriate immediately a large fraction of this extra amount through political contributions. A decrease in aggregate expenditures has the opposite effect, reducing growth and the level of profits in the market, and shifting the concerns of the policy-maker towards the utility of voters.

### 4.3 General equilibrium with lobbying

We now reintroduce the two general equilibrium conditions of the model that enable us to fully characterize the new steady-state in this economy under the presence of lobbying – the labor market clearing condition and the intertemporal profile of per capita expenditures required by consumer's utility maximization. When bargaining over the market structure, both agents take the level of expenditures as given. However, any shift in market structure changes individual decisions undertaken by firms, possibly creating a disequilibrium in the labor market that needs to be corrected through an adjustment in per capita expenditures. In turn, as expenditures jump to a new level, the number of firms that comes out of the political process must also change, since the marginal incentives faced by agents are shifted with $E$. This story implies that, in a steady-state with lobbying and fully rational players, $N^p(\lambda, E, r)$ must be set taking into account the interaction between the number of firms itself and per capita expenditures, as determined by the labor market clearing condition

$$N^p(\lambda, E, r) \cdot L_X\big(N^p(\lambda, E, r), E\big) + \mathbf{L}_z\big(N^p(\lambda, E, r), E, r\big) = L \tag{34}$$

Hence, with perfectly foresighted players, the economy jumps immediately to the new steady-state following the introduction of lobbying from a *laissez-faire* free-entry situation. Furthermore, as expenditures are still be a jump variable that adjusts at all times to satisfy the labor market clearing condition, it follows that $r = \rho$. Note that equation (34) summarizes a complex relationship. It states that, in the general equilibrium, given equilibrium expenditures $E^p$, the policy-maker restricts the number of firms to $N^p = N^p(\lambda, E^p, \rho)$, and given that there are $N^p$ active firms in the market, the equilibrium level of expenditures is $E^p$. In this sense, $E^p$ is a fixed point of (34).

Unlike the free-entry case, equation (34) may not define a unique equilibria. To check this, observe that an increase in $E$ presents two opposing effects over labor demand. The first is a direct (positive) effect, materialized into an expansion in production and innovation activities for the same number of firms, which results from an increase in gross-profits. The second is an indirect (negative) effect, which is translated into a decline in labor demand, motivated by the incentives of the policy-maker to restrict the number of R&D licences granted to firms. Furthermore, note that this decline may be continuous or discrete, since the selected number of firms may change discontinuously with $E$. Hence, labor demand may not be monotonically increasing in $E$, nor even continuous, which implies that we may have a multiplicity of equilibria, each characterized by different growth and welfare implications. Additionally, the existence of a fixed point is also not assured. This is particularly relevant for large values of $\lambda$, since in a highly concentrated market the few surviving firms may not employ enough resources to generate an equilibrium in the labor market, regardless of the size of aggregate demand. We discuss in greater detail the implications of multiple equilibria, as well as non-existence, later in this section. Here, we will simple assume that an equilibrium with lobbying exists and is well defined.[42]

### 4.3.1 General equilibrium and labor market adjustment

In order to dissect the general equilibrium effects brought in by political contributions, we must first analyze how the labor market reacts to a change in the market structure. Although we cannot determine the value of $E^p$ directly, it is still possible to establish a comparison with the free-entry equilibrium value. Using the expression for profits and rearranging, we can express aggregate R&D alternatively as

$$\mathbf{L}_z\big(N, E, r\big) = \frac{LE}{\xi(N)} - N\phi - \Pi(N, E, r) \tag{35}$$

Plugging (35) in the labor market clearing condition, and making use of the equilibrium market structure and the condition which defines the optimal saving policy of households, we obtain $E^p = E^f + \Pi(N^p, E^p, \rho)/L$. Since profits must be positive in an equilibrium with lobbying, if an equilibrium

[42]Although we do not explicitly formalize the possibility of multiple equilibria in this section, the results provided here can also be extended for this scenario.

exists we must have $E^p > E^f$. The intuition for this result works as follows. A lower $N$ is not only reflected in a higher price and a lower quantity in equilibrium, but also entails a reduction in aggregate fixed costs. Hence, it follows that total labor used in production decreases, for a given level of expenditures. Conversely, by increasing the level of gross profits, a higher concentration makes R&D more attractive, which leads to an increase in the total amount of real resources applied to the development of higher quality products, at least while the market is not too concentrated. Although these two effects work in opposite directions, the former always dominates the latter, and a more concentrated market employs a lower number of workers overall, for a given level of per capita expenditures. Hence, any decrease in the number of firms operating in the market results in an excess labor supply. Since labor demand is increasing in aggregate demand, $LE$, given the number of firms, expenditures must increase in order to restore equilibria. We can thereby postulate the following lemma

**Lemma 1.** *Assume an equilibrium with lobbying exists. Then, equilibrium expenditures in the presence of lobbying are higher relative to the* laissez-faire *free-entry general equilibrium.*

Observe carefully the implications of this result. Lobbying is able to sustain a lower number of firms in the market as compared to free-entry, enabling firms to achieve a positive level of profits. Part of these profits are given to the policy-maker as contributions, while the remaining are distributed as dividends to consumers. The policy-maker, in turn, redistributes his proceedings back to consumers, under the form of lump-sum transfers. In the end, expenditures are higher because the income of consumers has increased, and with it the value of the consumption basket they are able to afford.[43] Additionally, lemma 1 can also be given a different interpretation, in terms of the labor market. Since we chose the wage rate as numeraire, the increase per capita expenditures can be seen as an increase in $E/w$, or conversely, a decrease in the wage rate relative to expenditures. Hence, an alternative and perhaps more intuitive interpretation is that lobbying decreases labor demand, creating unemployment for a given wage rate. Equilibrium in the labor market can only be reestablished through a decrease in $w/E$. Nominal income of consumers relative to expenditures, however, remains unchanged, since dividends and lump-sum transfers balance completely the decline in the wage rate.

Finally, note that the composition of labor demand has changed. Since aggregate R&D is hump-shaped in $N$ and increasing in $E$, it must go up in the general equilibrium, at least while concentration in the market is

[43]Note that this is different than saying that they are able to afford a higher number of goods. An increase in concentration also raises the price consumers have to pay for each variety.

Table 1: Lobbying – impact on welfare

| | Number of firms (N) | | | Expenditures (E) | | |
|---|---|---|---|---|---|---|
| Effects | Variety | Compet. | Growth-N | Growth-E | Expendit. | **Welfare** |
| Partial Eq. | − | − | + | | | − |
| General Eq. | − | − | + | + | + | + |
| **Welfare** | − | − | + | + | + | ? |

maintained at moderate levels. Since labor supply is constant, labor applied in production must be lower. We can therefore put forward our second lemma:

**Lemma 2.** *Assume an equilibrium with lobbying exists. Then, in the general equilibrium, if the preference for political contributions is not excessively high, lobbying induces a substitution between labor used in production and labor applied in R&D as compared to the* laissez-faire *free-entry general equilibrium.*

### 4.3.2 Equilibrium growth and welfare with lobbying

Let $\mathbf{L}_z^p = \mathbf{L}_z\big(N^p, E^p, \rho\big)$ denote equilibrium R&D. The equilibrium growth and welfare are, respectively

$$g^p = \theta \cdot \frac{1 + \gamma(N^p - 1)}{N^p} \cdot \mathbf{L}_z^p$$

and,

$$U^p = \frac{1}{\rho}\left[\frac{1}{\varepsilon - 1}\log N^p + \log\frac{\xi(N^p) - 1}{\xi(N^p)} + \frac{g^p}{\rho} + \log E^p\right]$$

Figure 4 compares the current outcome with lobbying with that obtained under the *laissez-faire* equilibrium.[44] Note that it is not the shift in the market structure that is driving the increase in welfare, but the general equilibrium effects of lobbying over aggregate expenditures. Overall, we can identify five effects at work here, that are able to influence society's welfare when an equilibrium with lobbying is compared to the free-entry outcome – three common both to the partial and general equilibrium, and two exclusively with general equilibrium foundations. These effects are summarized in table 1.

The introduction of lobbying in the economy leads some firms to leave the market, therefore increasing concentration and reducing labor demand, given the level of expenditures – this generates the partial equilibrium effects

[44] The labor demand plotted in the figure is a general equilibrium labor demand, *i.e.*, it represents the demand for labor for the general equilibrium number of firms. In other words, it is the left hand side of equation (34), which takes into account how a change in $E$ is reflected in the equilibrium number of firms itself.

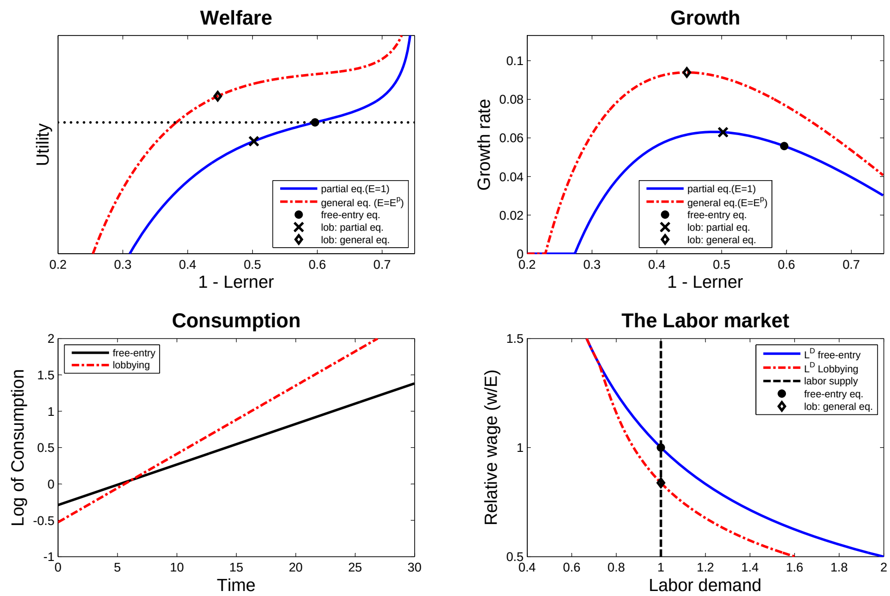


Figure 4: Lobbying generates an increase in per capita expenditures; growth increases and welfare may also increase.

analyzed before. In the general equilibrium, however, labor market clearing requires a decrease in the price of labor relative to expenditures. Since the number of firms bargained between the policy-maker and the lobby responds endogenously to this adjustment, concentration in the market will increase further. *Ceteris paribus* (given $E$), this adjustment only extends the partial equilibrium effects – a higher markup, a lower number of varieties, and a (possibly) higher growth rate –, with a negative repercussion over utility. Furthermore, a lower unitary cost of production relative to the size of demand means that the level of gross-profits per unit of labor, for the same $N$, has become higher, which fosters R&D and consequently economic growth. This implies that the growth schedule shifts upwards, providing consumers with a more robust increase in welfare over time – the first exclusive general equilibrium effect of lobbying over utility. Finally, note that products have become cheaper relative to the size of aggregate demand. Consumers are now able to afford a larger set of goods for the same number of firms – the second exclusive general equilibrium effect of lobbying over utility. The impact of lobbying over welfare depends on the complex interaction between these five effects. In particular, if the effects implied by the reduction in the number of firms can be completely offset by the two specific general equilibrium effects, which mirror the increase in aggregate expenditures, the new equilibrium comprises a higher welfare as compared to the *laissez-faire* free-entry equilibrium. We summarize this discussion in the following result:

**Result 2.** *Assume an equilibrium with lobbying exists. Then, when com-*

*pared to the* laissez-faire *free-entry general equilibrium, lobbying:*

*(i) decreases the active number of firms;*

*(ii) increases the growth rate (if the preference for political contributions is not excessively high);*

*(iii) may increase welfare.*

It follows that lobbying might be able to improve welfare over a welfare maximizing free-entry equilibrium, through an increase in the relative size of demand, which is materialized in the general equilibrium. Note that, if $\lambda$ is allowed to take high values, theoretically the growth rate may not necessarily increase, since a higher market concentration would actually decrease labor applied in R&D, which would balance against the general equilibrium effect of expenditures in the growth schedule. However, as long an equilibrium exists, our numerical results suggest that the general equilibrium effect prevails and growth always increases.

This result can also be examined from an intertemporal perspective of consumption. Despite the increase in households' income, due to the extra profits generated by firms, there are now fewer products, and all of them have become more expensive. The latter two effects dominate, and hence lobbying as a negative impact on present consumption – had the growth rate stayed unchanged, consumption would have never increase, at any point in time, in virtue of lobbying. However, by changing individual incentives faced by firms, the actions of a voracious policy-maker are able, although indirectly, to increase the rate of innovation in the economy, enabling a more significant and sustained increase in the services provided by those goods over time. It is this increase in the growth rate that supports the potential welfare gain with lobbying, as compared to free-entry.

## 4.4 General equilibrium: Additional issues

### 4.4.1 General equilibrium and steady-state multiplicity

The number of equilibriums in this economy is determined by the number of values of $E$ that satisfy the labor market clearing condition, represented by equation (34). Since labor demand, in the general equilibrium, does not need to be monotonically increasing in per capita expenditures, nor even continuous, different values of $E$ may lead to the same quantity of labor demanded by firms. While we were not able to determine analytically the maximum number of possible equilibriums, our numerical results suggest that the economy may have up to three distinct steady-states, each endowed with different growth and welfare implications. In order to understand why, let us separately analyze under which circumstances we may have two or three equilibra. These two cases are illustrated in appendix A.3.

**The case of two equilibria.** A situation with two equilibria may arise if labor demand is not continuous in per capita expenditures, which, in turn, requires that $N(\lambda, E, \rho)$ is not continuous in $E$. As we discussed before, such situation can only occur if a small increase in per capita expenditures is able to potentiate an expansion in aggregate profits in such a way that the policy-maker is better off by changing completely the policy in the benefit of firms. As this shift is materialized in a nearly monopolistic market structure, further increases in $E$ will not have anymore any significant impact on the active number of firms. This implies that, although labor demand tends to be predominantly increasing in $E$, there exists a critical level of expenditures where the indirect effect of a fall in the number of firms will predominate, and labor demand falls discontinuously at that point. Therefore, the equilibrium condition in the labor market can be satisfied for, at most, two distinct levels of expenditures.

**The case of three equilibria.** A situation with three equilibria may arise if the decrease in the labor demand determined by the decline in the active number of firms due to an increase in $E$ is able to overcome the direct effect of per capita expenditures on labor demand. However, such state of affairs can only occur if the incentives of the policy-maker are highly responsive to $E$, situation in which the selected number of firms converges very quickly to its lower bound. Once this adjustment is undertaken, the indirect effect of expenditures over labor demand dissipates, and only the direct effect remains. Hence, labor demand in the general equilibrium can present at most one region where it is decreasing in $E$ (conversely increasing in $1/E$), which implies that we may have, at most, three fixed points in equation (34).

The existence multiple equilibria leads to the crucial question of how the economy selects between them. Since $N$ is a jumping variable, all equilibria are feasible, and the selection between different equilibria depends exclusively on agents expectations about future entry, exit, price, investment and political contributions. However, none of these equilibria is predominantly superior in terms of welfare, *i.e.*, depending on the structure of the economy, there does not exist one equilibrium that systematically dominates the others, or that systematically dominates the free-entry equilibrium. Hence, all the analysis developed in the previous section can be extended to immediately contemplate the current cases, as long as one considers the equilibrium represented therein as one of the possible three equilibria that may exist in the model.[45]

[45] However, our calibration results, that we report in the next section, hint that only one equilibrium with lobbying exists when the parameters are selected in order to represent the long-run macroeconomic facts of the U.S. economy.

### 4.4.2 Non-existence of general equilibrium

As we observed before, the existence of an equilibrium in the labor market is not assured. However, this situation can only occur if the preference for political contributions is sufficiently high, since only then total labor demanded by firms may not suffice to attain full employment, no matter the level of expenditures. To understand this fact recall that, as $E$ increases to correct for disequilibriums in the labor market, the incentives of the policy-maker are also changing towards further restrictions in the number of R&D licences emitted, which pushes aggregate labor demand in the opposite direction. If $\lambda$ is large enough, then the market structure converges to the monopolistic case at a rate which may be sufficient to induce an excess labor supply for all values of per capita expenditures, as illustrated in appendix A.4. In such situation, aggregate R&D approaches zero (as the maximization condition of firms originates a corner solution at $L_z = 0$), and so does total sales (as the price level converges to infinity), and therefore it follows that total labor demand converges to $\phi$ for finite $E$. Hence, the following result arises:

**Result 3.** *If the preference for political contributions is sufficiently high, no general equilibrium exists with lobbying.*

As a fully voracious policy-maker always sets a monopolistic market structure, an immediate corollary emerges:

**Corollary 1.** *There exists no general equilibrium with lobbying if the policy-maker if fully voracious.*

Finally, note that it is always possible to find an upper bound for $\lambda$ below which an equilibrium is always defined. Our general equilibrium analysis presented thus far assumed implicitly such condition, so that no non-existence problems arose.

## 4.5 Preference for contributions and welfare: the possibility of non-linear effects

A crucial question in our model is how equilibrium welfare changes as the policy-maker becomes more voracious. While the effects of a larger preference for political contributions are obvious regarding equilibrium market structure and equilibrium growth, the same is not true when welfare comes into consideration. Various combinations are possible, including (monotonically) positive and negative relationships between equilibrium utility and $\lambda$. There is, however, a stunning possibility – the existence of a non-linear relationship between equilibrium welfare and the weight of contributions in the policy-maker's utility function, as illustrated in figure 5.

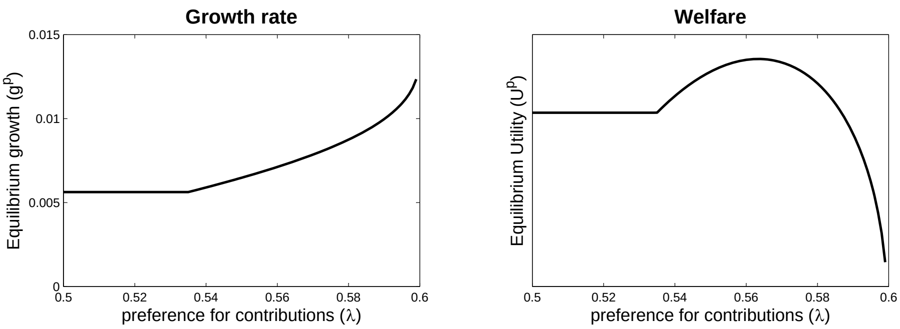


Figure 5: Equilibrium growth and welfare when there exists a non-linear relationship between the latter and the preference for contributions.

This possibility arises because the interaction between the five effects that drive the change in welfare under lobbying as compared to the *laissez-faire* equilibrium is highly influenced by the value of $\lambda$. For smaller values of $\lambda$, it may happen that the increase in aggregate demand relative to the cost of labor, which raises the growth rate and allows consumers to buy more goods for the same number of firms, is able to offset the escalation in the price level and the fall in the number of varieties that occurs in equilibrium, determining an increase in welfare. However, slightly higher values of $\lambda$ may originate the reverse interaction and lead to a decline in utility. Intuitively, households may be willing to accept a small increase in concentration in exchange for an expansion in aggregate income and a higher growth rate, but regard a large decrease in the number of varieties as substantially harmful, even if it is associated to a higher income. Hence, we can bring forward the following:

**Result 4.** *Equilibrium welfare may change non-linearly in response to an increase in the preference factor for political contributions.*

### 4.6 Steady-state contributions

In order to pin down the effects of lobbying over equilibrium growth and welfare, it is sufficient to model an efficient bargain between the lobby and the policy-maker; the way contributions are determined in equilibrium is completely irrelevant. This only occurs because we have assumed that the policy-maker distributes the proceeds from contributions back to households, through lump-sum transfers, since, in this case, households' expenditures do not depend on the distribution of surplus. However, in order to close the model, something should be said about the equilibrium level of contributions.

The total amount of surplus generated in the bargain is simply the increase in aggregate profits minus the net revenue of the policy-maker necessary to leave him indifferent between a market structure of $N^p$ and $N^f$. Note that the policy-maker may not be reimbursed in equilibrium – since expenditures increase, lobbying may originate an increase in utility as compared to free-entry, and *ex-post* the policy-maker may even be willing to pay in order to provide households with such utility gain. Making use of the individual rationality constraints plus the free-entry condition $\Pi(N^f, E^f, \rho) = 0$, the equilibrium surplus per unit of time becomes

$$S = \Pi^p + \frac{\rho \cdot \left[U^p - U^f\right]}{\lambda'}$$

where $\Pi^p = \Pi(N^p, E^p, \rho)$ denotes the total amount of instantaneous profits (before contributions are paid) with lobbying and the remaining notation was previously introduced. Assume both players have agreed to share this surplus, such that the lobby obtains a share $\alpha \in [0, 1]$ of this amount, while the remaining surplus is allocated to the policy-maker.[46] Hence, the lobby will obtain instantaneous profits net of contributions totaling $\overline{\Pi} = \alpha S$, while the policy-maker attains an utility of $\overline{U} = (\lambda'/\rho) \cdot (1-\alpha)S$. Finally, using the individual rationality constraint for the lobby, instantaneous contributions become

$$\Psi^p = (1 - \alpha)S + \frac{\rho \cdot \left[U^f - U^p\right]}{\lambda'}$$

which states that firm's contributions can be decomposed into the sum of the share of surplus generated by the bargain that was assigned to the policy-maker with the minimum net revenue necessary to make the policy-maker indifferent between a market structure of $N^p$ and $N^f$.

# 5 A calibration exercise

In order to provide a better match to the long-run features of the U.S. economy, we start by extending the model to contemplate a constant relative risk aversion (CRRA) flow utility. In this way, we can appropriately take into account a significant branch of the literature, which suggests that the elasticity of marginal utility is greater than one. Afterwards, we calibrate the model for the U.S. economy and illustrate how lobbying might have influenced the determinants of long-run growth and welfare.

## 5.1 Extending the model: The CRRA specification

Here, we briefly summarize the main changes introduced in the model when the flow utility is extended to a CRRA specification. The typical household now seeks to maximize the following lifetime utility

[46] This analysis relies on the notion of Asymmetric Nash Bargain, along the lines of Binmore et al. (1986)

$$u(t) = \int_t^{\infty} \frac{C(\tau)^{1-\sigma} - 1}{1-\sigma} e^{-\rho(\tau - t)} \mathrm{d}\tau, \ \sigma > 1$$

subject to the usual budget constraint. The first-order condition can be immediately obtained

$$\frac{\dot{E}}{E} = \frac{r - \rho}{\sigma} + \frac{\sigma - 1}{\sigma} \frac{\dot{P}_C}{P_C} \tag{36}$$

The demand schedules are the same as before, as well as the characterization of the economic market and the growth function. The partial equilibrium is also as before, except that, in the case of lobbying, the utility function of the policy-maker must contemplate the new lifetime utility of households, which can be summarized as

$$U(N, E, r) = \frac{\left[N^{1/(\varepsilon-1)} E\big(\xi(N) - 1\big)/\xi(N)\right]^{1-\sigma}}{(1-\sigma) g(N, E, r) - \rho}$$

**Free-entry: the general equilibrium**

Under free-entry, labor market clearing in the current framework still implies an equilibrium value for expenditures of unity. Since $P_C$ is a quality weighted price index, it evolves over time according to the symmetric of the growth rate, *i.e.* $\dot{P}_C/P_C = -g(N, E, r)$. Intuitively, goods are becoming cheaper over time as compared to the services they are able to provide, and hence the price of the consumption basket must be falling at the rate quality is increasing. Making use of this relationship in (36), plus the fact that $E^f = 1$, the equilibrium interest rate is the fixed point of the following equation

$$r = \rho + (\sigma - 1) g\big(N^f(1, r), 1, r\big) \tag{37}$$

Some numerical exercises show that existence is not always assured, but for the calibrated parameters the issue of non-existence does not arise. Using the equilibrium values for $r$ and $E$, we can immediately obtain the equilibrium market structure, growth, and welfare.

**Lobbying: the general equilibrium**

With lobbying, the equilibrium pair $(E, r)$ must solve simultaneously the labor market clearing condition,

$$N^p(\lambda, E, r) \cdot L_X\big(N^p(\lambda, E, r), E\big) + \mathbf{L}_z\big(N^p(\lambda, E, r), E, r\big) = L$$

and the intertemporal profile of per capita expenditures implied by households utility maximization

$$r = \rho + (\sigma - 1) g\big(N^p(\lambda, E, r), E, r\big) \tag{38}$$

Again, existence and uniqueness are not guaranteed, but, if an equilibrium exists, it is numerically possible, through an iterative procedure, to recover the values for expenditures and the interest rate, and subsequently the market structure, growth and welfare. We will, however, undertake a different approach, explained below.

## 5.2 Calibration of the model

Several parameters in our model have close real-world counterparts and so they can be calibrated directly from the data. For this purpose, we follow related studies of numerical R&D models. Others, however, require a more indirect approach. Since lobbying and campaign contributions comprehend billions of dollars every year, we interpret our benchmark calibration as representative of an outcome with lobbying. Thereafter, we proceed backwards, identifying what would be the outcome for the U.S. economy had lobbying been completely prohibited in the first place, and compare the long-run economic performance between the two situations.

### Matched empirical facts

We calibrate the model such that the equilibrium interest and growth rates match the U.S. empirical data. This implies that some parameters of the model must be calibrated internally. The long-term interest rate ($r^p$) is set to 7 percent, which is the estimated average real rate of return on the stock market over the past century (Mehra and Prescott, 1985; Jones and Williams, 2000).[47] The growth rate ($g^p$) is set to 2.1 percent, which is the estimated growth rate of consumption per capita for the post-war period, as reported in Comin (2004).[48] This value is also comprised within the GDP per capita growth rates reported in the literature for the same period of time, which range from 1.7 to 2.3 percent, depending on the data source and on the time span considered. We admit a range of values for the number of workers in R&D ($L^p$) between 12 and 15 percent, consistent with the data provided by the International Labor Organization for the manufacturing sector.

[47] As Jones and Williams (2000) note, since the interest rate in R&D driven models is also the rate of return to R&D, it cannot be calibrated to the risk-free rate on t-bills.

[48] Since the growth rate in our model corresponds to that of consumption, we feel more comfortable with this approach rather than calibrating $g^p$ according to the GDP per capita growth rate.

**A typical calibration**

We normalize the population to one, since the model becomes easier to calibrate and seems to perform better relative to alternative values of $L$. In accordance with the literature (e.g. Strulik, 2007; Funke and Strulik, 2000), we set the benchmark value for the elasticity of marginal utility ($\sigma$) to 2. According to the general equilibrium condition (38), this implies an intertemporal discount factor of 0.049.

Contrary to most models of endogenous growth that consider the case of monopolistic competition, the value of the elasticity of substitution between two different varieties ($\varepsilon$) in our model cannot be directly obtained through the empirical estimates of the markup price, since these depend on the equilibrium number of firms, which is endogenously determined. Therefore, we undertake a slightly different approach here. We set a reasonable value for $\varepsilon$, and require, *ex-post*, that the equilibrium markup is comprised within an acceptable range; otherwise we re-calibrate the value of $\varepsilon$. The literature is not unanimous as regards to the markup price, providing different values depending on the type of product considered. Some empirical estimates suggest lower values for the markup, ranging up to 40 percent (e.g. Basu, 1996), while others hint slightly higher values, which can exceed 70 percent (e.g. Roeger, 1995; Funke and Strulik, 2000). Consistent with this, and also attending to the fact that our model considers quality driven R&D, which is usually associated to larger markups, in part due to the market power conferred by the patent system, we define an acceptable range for $p$ of 1.4-1.6. After some trial and error, we found a value of $\varepsilon = 6$ performs quite well, frequently providing a price level within this interval.

Another parameter which has to be recovered through a similar method is the quantity of labor associated to overhead expenditures per firm ($\phi$), since only the total amount, $N^p \cdot \phi$, can be retrieved from the data. Depending on how one classifies some activities as fixed or variable costs of production, and on the time span considered, the labor allocated to fixed cost activities in the manufacturing sector seems to range from 10 to 20 percent of total labor, according to the statistical database of the International Labor Organization. Hence, we define a value of $\phi$ such that, *ex-post*, $N^p \cdot \phi$ is within this range. After some experiments, we decided to set $\phi$ at 0.07.

The elasticity of quality with respect to R&D ($\theta$) and the level of spillovers ($\gamma$) have to be calibrated simultaneously. Let us suppose, for a moment, that we know the true value of $\lambda$ – the value that, given $\theta$ and $\gamma$, implies an equilibrium level of per capita expenditures such that equilibrium growth equals the calibrated value of 2.1 percent. We call this consistency condition – *ex-post*, the model must be consistent, in sense that it must generate the same growth rate that we initially assumed to retrieve the discount factor; otherwise, at least one of the general equilibrium conditions is violated. The consistency condition is automatically violated if, given $\theta$ and $\gamma$, no value of

Table 2: Parameter values

| | Parameter | Value |
|---|---|---|
| Interest rate | $r^p$ | .07 |
| Growth rate | $g^p$ | .021 |
| Population | $L$ | 1 |
| Marginal elasticity of substitution | $\sigma$ | 2 |
| Elasticity of substitution between varieties | $\varepsilon$ | 6 |
| Spillovers | $\gamma$ | .7 |
| Quality-R&D elasticity | $\theta$ | .18 |
| Fixed cost | $\phi$ | .07 |
| Discount factor | $\rho$ | .049 |

$\lambda$ assures an equilibrium growth of 2.1 percent. Given this requirement, we can numerically find an interval for $(\theta, \gamma)$ such that the model is consistent and the equilibrium labor allocated to R&D is between 12 and 15 percent. The acceptable range for $\theta$ lies between 0.15 and 0.20 – values above this interval do not respect the consistency condition, while values below this interval do not replicate U.S. empirical facts on labor allocated to R&D, for any value of spillovers. Given this range for $\theta$, we can numerically find a lower bound for $\gamma$ as a function of $\theta$, $\gamma(\theta)$, with $\gamma'(\theta) > 0$, above which the model is always consistent and provides reasonable values for R&D. For our benchmark, we set $\theta = 0.18$ and $\gamma = 0.7$, which is compatible with an R&D labor share around 13.6 percent. Table 2 summarizes our benchmark calibration.

**Retrieving the preference for political contributions ($\lambda$)**

Above, we assumed that we knew the value of $\lambda$ such that, for each pair $(\theta, \gamma)$, the model was kept consistent. However, the value of $\lambda$ that enables the model to replicate the empirical growth rate that we have initially assumed has also to be determined. In particular, this value must be such that the equilibrium level of expenditures and the equilibrium market structure yield a growth rate exactly equal to 2.1 percent. In practice, we proceed as follows. Given certain values for $\theta$ and $\gamma$, we define a grid for $\lambda$ and compute the equilibrium for each value in that grid. Then, we select the value of $\lambda$ such that the equilibrium growth rate equals the pre-set one. If no $\lambda$ replicates the empirical facts that we considered initially, we change the pair $(\theta, \gamma)$ and redo the calculations. The selected triplet $(\theta, \gamma, \lambda)$ must satisfy the following two requirements: an equilibrium with a growth rate of 2.1 percent must exist and the share of labor allocated to R&D must be comprised between 12 and 15 percent.

**Identifying the free-entry growth rate**

With our calibrated parameters, we can immediately retrieve the equilibrium growth rate for the unobserved *laissez-faire* framework. In fact, all that is necessary is to solve (37), considering the value of $\rho$ obtained from the calibrated model above. Once we extract $r^f$, characterizing the free-entry equilibrium is immediate.

## 5.3 Results

The results are summarized in table 3 and illustrated in figure 6. For the calibrated model, we estimated a free-entry growth rate of 1.73 percent, almost .4 percentage points below the empirical value. This outcome is mainly motivated by the 2 percentage points difference in labor allocated to R&D between the two situations, and suggests that lobbying may influence the long-run performance of the U.S. economy. In addition, with lobbying, industry profits are positive, representing about 5 percent of the total income of workers, and concentration is slightly larger, as well as the markup, when compared to free-entry. In which concerns to welfare, lobbying represents a welfare gain of 3.5 percent in consumption equivalent terms, sustained through lower consumption at time 0, but a higher consumption pattern later on. This time path for consumption is supported by the paradigm varieties-price/expenditures-growth, with the later being key to explain how entry restrictions are able to improve upon the free-entry equilibrium. These results are qualitatively robust to every suitable sensitivity analysis that we undertook.

One striking feature of the calibrated model is that lobbying does not only raise welfare, but also that equilibrium welfare is increasing in total lobbying efforts. In this stance, one could attain higher growth rates and larger utility gains if policy-makers in the U.S. economy were even more voracious and more eager for political contributions. This apparent paradoxical result, however, has its foundations in a crucial assumption of the model – contributions are redistributed back to households, in the form of lump-sum transfers. While this assumption enabled us to make the model highly tractable, it may not be completely realistic, since policy-makers are not getting hold of any direct benefit that could be obtained from these contributions. Below, we numerically generalize the model so that only a fraction of total profits is redistributed back to households; the remaining will be spent by politicians for their own personal benefits.

## 5.4 Extending the model: the role of contributions

Let us consider now that the policy-maker uses the proceeds from contributions to buy goods from firms, instead to redistributing them back to households. In particular, suppose that the policy-maker shares the same

Table 3: Calibration results

| | Parameter | Lobbying | Free-entry |
|---|---|---|---|
| Preference for contributions | $\lambda$ | .4444 | — |
| Expenditures | $E$ | 1.0520 | — |
| Industry Profits | $\Pi$ | .0520 | — |
| Relative wage | $w/E$ | .9505 | — |
| 1 - Lerner Index | $\bar{l}$ | .6980 | .7313 |
| Markup | $p-1$ | .4327 | .3673 |
| R&D labor share | $\mathbf{L}_z$ | .1355 | .1150 |
| Share of labor used in production | $N \cdot L_X$ | .8645 | .8850 |
| Share of variable costs | $N \cdot X$ | .7343 | .7013 |
| Share of fixed costs | $N \cdot \phi$ | .1302 | .1537 |
| Interest rate | $r$ | .0700 | .0663 |
| Growth rate | $g$ | .0210 | .0173 |
| Utility gain (%) | | 2.48 | — |
| Consumption equivalent gain (%) | | 3.5 | — |
| Consumption gain at $t$ (%) | | -2.96 | — |
| Consumption gain after 10 years (%) | | .78 | — |
| Consumption gain after 25 years (%) | | 6.53 | — |
| Consumption gain after 50 years (%) | | 16.83 | — |

preferences of households as regards to intermediate goods, such that his demand schedule his identical. His preferences for contributions are still driven by the same utility function as before. In such framework, the demand schedule faced by each firm is identical to that of the benchmark model, which implies that equilibrium expenditures and growth remain unchanged. Households' income and consequently equilibrium welfare are now lower, since a fraction of the economy's income will be spent by politicians; however, the exact amount in which equilibrium welfare is depressed depends on the distribution of surplus between the lobby and the policy-maker. This alternative specification extols the role of the Nash Bargaining process in the final welfare allocation, since, depending on the share of surplus that is redistributed back to households, welfare can increase or decrease as compared to the *laissez-faire* equilibrium. These interactions are illustrated in figure 7.

Table 4 and figure 8 summarize the results, for an asymmetric Nash Bargain in which 60 percent of the surplus is allocated to households. Since the outcomes for the Lerner index, markup, R&D share, interest rate and growth rate are similar or identical to those presented in table 3, we omit them for brevity. Notably, since households' income is now about 2 percent less relative to the previous calibration, the utility gain is now much lower. That is, although consumption growth remains unchanged, households have now to renounce to a larger fraction of consumption at moment 0, and hence more time needs to be elapsed until the benefits of lobbying are felt over instantaneous welfare. Equilibrium welfare now depends non-linearly

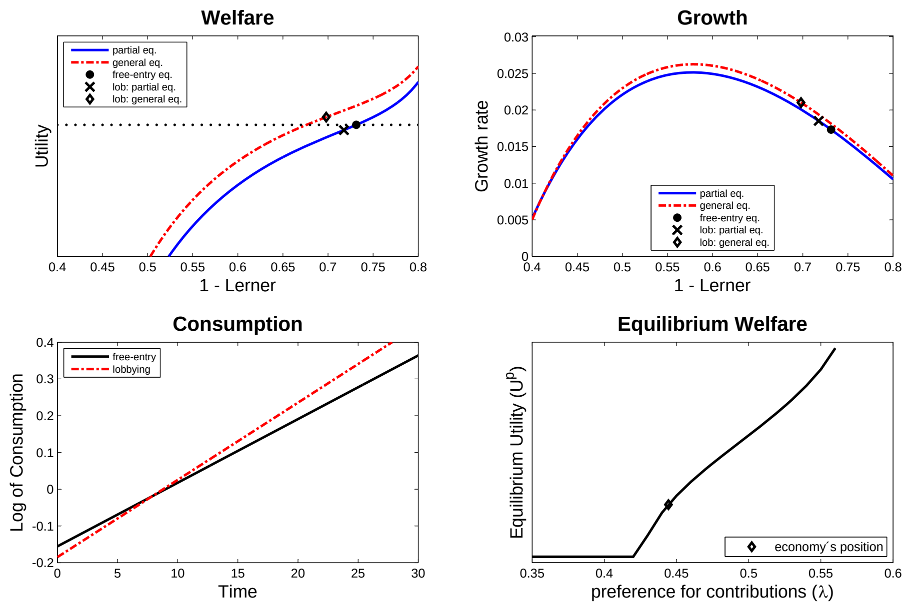


Figure 6: Calibration results – Lobbying may increase welfare as compared to the *laissez-faire* free-entry equilibrium.

on the preference for political contributions, due to a shift in the the forces that drive the paradigm varieties-price/expenditures-growth, which resulted from a less noteworthy increase in aggregate demand from households. This change in the model puts an upper bound on the benefits that can be extracted through lobbying. For the current calibrated parameters, welfare gains with lobbying can be obtained if at least approximately 50 percent of the surplus is allocated to households.

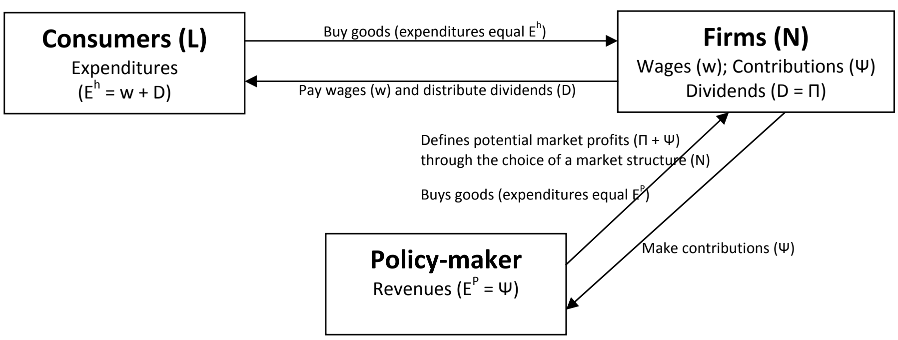


Figure 7: Venn diagram with the interaction between economic agents, in the modified model.

Table 4: Calibration results for the modified model

| | Parameter | Lobbying | Free-entry |
|---|---|---|---|
| Distribution of surplus (fraction) | | | |
| Firms (households) | | .6 | — |
| Policy-maker | | .4 | — |
| Preference for contributions | $\lambda$ | .4493 | |
| Total expenditures | $E$ | 1.0520 | |
| Household expenditures | $E^h$ | 1.0312 | |
| Policy-maker expenditures | $E^P$ | .0208 | |
| Industry profits before contributions | $\Pi$ | .0520 | |
| Utility gain (%) | | .51 | — |
| Consumption equivalent gain (%) | | .69 | — |
| Consumption gain at $t$ (%) | | -4.78 | — |
| Consumption gain after 10 years (%) | | -1.23 | — |
| Consumption gain after 25 years (%) | | 4.40 | — |
| Consumption gain after 50 years (%) | | 14.48 | — |

### 5.5 The role of lobbying: a reassessment

In general terms, our model suggests that special interest groups – firms – lobby decision-makers in exchange for more favorable policies – legislation – that, to some extent, influence market structure and the profitability of firms. *Ceteris paribus*, this change in policy is apparently harmful for the society, a conclusion that is in line to what is usually perceived in the literature as the effects of rent-seeking over economic activity. In terms of our model, this change in legislation originates less competition in the product market, leading to higher prices and a reduction in the number of brands (which can be, to some extent, refrained through the increase in the growth rate).

Nevertheless, as we stated in the beginning, the costs incurred by firms in lobbying and campaign contributions represent a small fraction of the benefits they can reap from such activities, which hints that the distribution of surplus generated from the bargain between lobbies and decision-makers is biased in the benefit of the former, such as in the example in table 4. If this is the case, a significant fraction of this surplus is converted into dividends, increasing households' income and expanding aggregate demand. Although this shift in aggregate demand is not enough to prevent the fall in present consumption, households will most certainly benefit from higher future consumption, since firms realize that one unit of R&D is now more profitable and increase the rate of product innovation. Together, these two effects – a higher growth rate and a larger aggregate demand – are responsible for the raise in welfare as compared to the *laissez-faire* free entry equilibrium.

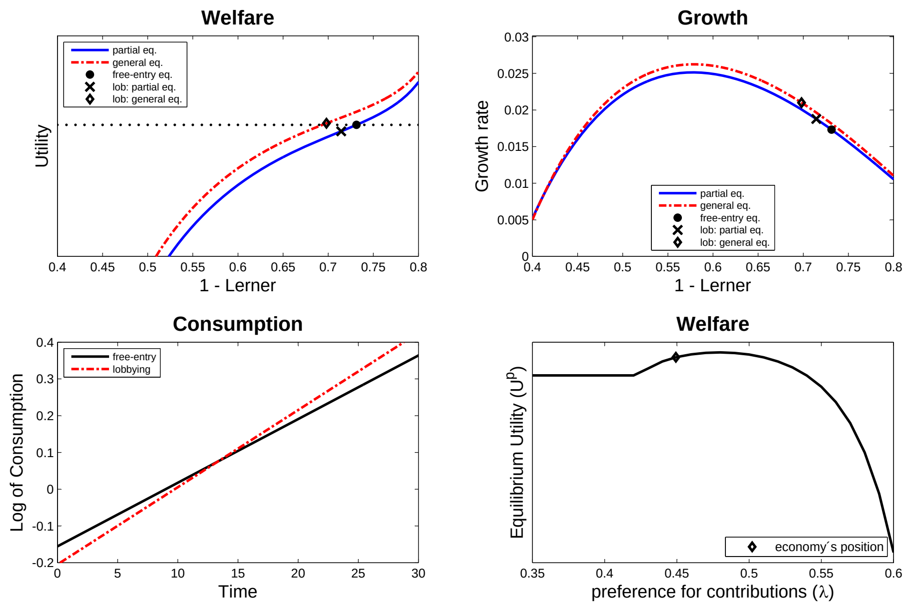


Figure 8: Calibration results for the modified model – Lobbying may increase welfare as compared to the *laissez-faire* free-entry equilibrium, however equilibrium growth depends non-linearly on $\lambda$.

# 6 Concluding remarks

We have argued that the effects of lobbying over economic growth and welfare can only be truly analyzed in a model which explicitly takes into account the interaction between policy-makers and firms, and the inherent partial and general equilibrium repercussions over the economy. Along these lines, we found that lobbying, although prejudicial for the society in a sectorial perspective, may improve welfare over a welfare maximizing *laissez-faire* free-entry equilibrium, once the general equilibrium adjustments over economic aggregates are taken into consideration. This result introduces a new paradigm in the literature about the effects of lobbying over economic performance.

Much is left to be done, though. A complete and integrated analysis of the impact of some rent-seeking phenomena over economic growth and welfare can only be achieved through a deeper understanding of the interactions between economic agents and consequent repercussions over economic activity. The literature as systematically neglected this interaction, which we believe is crucial to explain the relationship between rent-seeking and economic performance.

# Appendix

## A Additional figures

### A.1 Gross-profit effect versus business-stealing effect

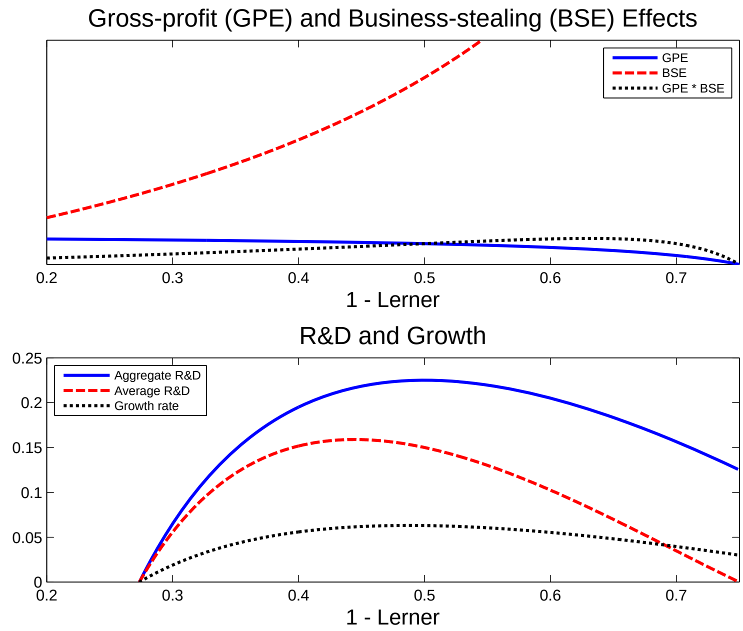


Figure 9: The gross-profit and the business-stealing effects and the shape of the growth rate (population normalized to one).

### A.2 The *laissez-faire* equilibrium

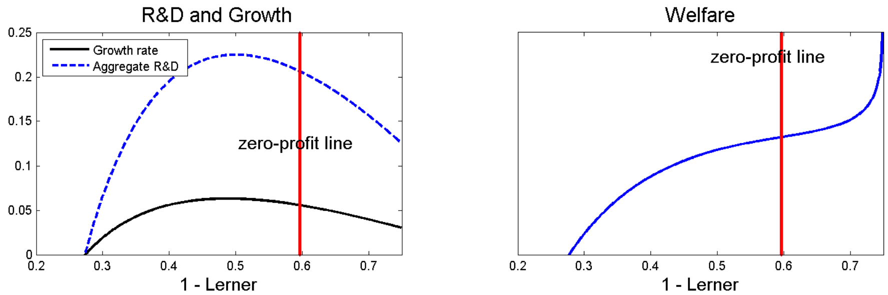


Figure 10: Welfare and growth under free-entry: the benchmark case (population normalized to one).

### A.3 Lobbying and the general equilibrium – multiple equilibria

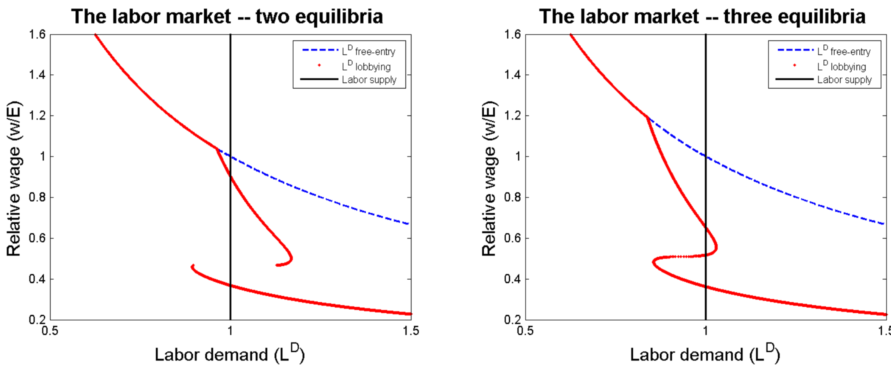


Figure 11: The labor market: multiple equilibria (population normalized to one).

### A.4 Lobbying and the general equilibrium – non-existence

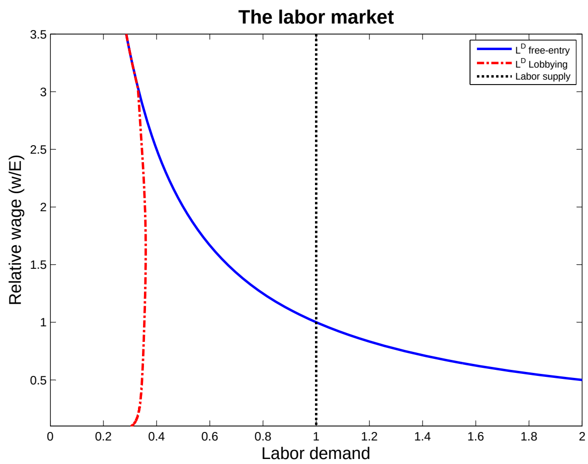


Figure 12: The labor market: non-existence of general equilibrium (population normalized to one).

## B The hump-shaped utility case

### Industry equilibrium

In the case where the utility of the representative individual is not everywhere increasing in $\bar{l}$, lobbying might boost both welfare and growth relative to the *laissez-faire* equilibrium, as depicted below. By restricting the number of R&D licences, the policy-maker is be able to increase market profitability to a substantial extent, thereby planting seeds to a more fierce competition between the surviving firms, who will seek to capture the largest share of this amount through more frequent quality improvements in their products. If the resulting increase in the growth rate is able to overcome the higher price level and the fall in the number of varieties, then consumers will be better off with lobbying. Observe, however, that it is not lobbying *per se* that is driving welfare up, but the simple option to change the market structure, that was not available in the free-entry equilibrium. Even if we take $\lambda = 0$, the policy-maker will change the active number of firms, due to the simple fact that the *laissez-faire* equilibrium is inefficient from the society's point of view. The (negative) effect of lobbying in the partial equilibrium should then be the potential decrease in welfare registered as the number of firms falls below the welfare maximizing level, and not the difference registered relative to the *status quo* benchmark.

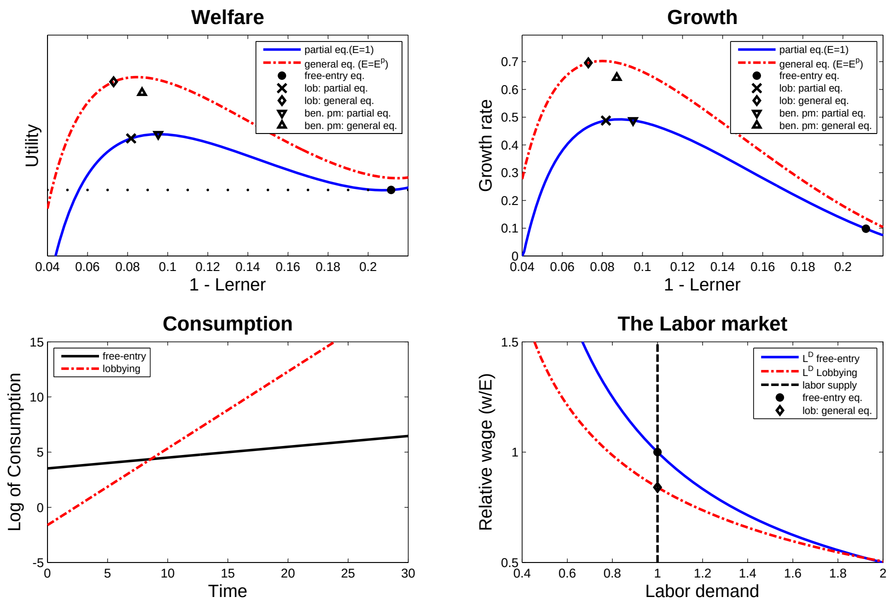


Figure 13: The HU case. Lobbying generates an increase in per capita expenditures; growth increases and welfare may also increase.

## General equilibrium

The simple possibility of allowing a policy-maker to select the number of firms induces a change in the market structure, which is consequently reflected in the general equilibrium through an increase in the value of per capita expenditures. Hence, the true effect of lobbying over welfare is not the change in welfare between the final allocation and the free-entry equilibrium, but instead the change in welfare between the final allocation and the welfare maximizing allocation that a benevolent policy-maker would select.

Once this distinction is made, the analysis undertaken in the text can be immediately applied, with the exception that the welfare maximizing allocation takes the role of the free-entry outcome. Hence, it follows that lobbying can still improve welfare over a welfare maximizing equilibrium. Since a benevolent policy-maker is always able to improve welfare over the free-entry equilibrium, the final allocation with lobbying will almost surely imply a greater level of welfare as compared to the free-entry equilibrium. Such situation is depicted below.

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